

THE IMPACT OF NFC AND QRIS UTILIZATION IN LIVIN' BY MANDIRI ON SMART MOBILITY EXPERIENCE AMONG PUBLIC TRANSPORTATION USERS IN DKI JAKARTA

Nazwa Eka Putri¹, Afidah Nur Aslamah², Osly Usman³, Ryna Parlyna⁴

¹ Universitas Negeri Jakarta, Indonesia

² Universitas Negeri Jakarta, Indonesia

³ Universitas Negeri Jakarta, Indonesia

⁴ Universitas Negeri Jakarta, Indonesia

Email: nazwaekap11@gmail.com¹, afidah.nur@unj.ac.id², oslyusman@unj.ac.id³, rynaparlyna@unj.ac.id⁴

Article Info

Article history:

Received: 16 December 2025;

Accepted: 22 December 2025;

Published: 29 December 2025.

Keyword:

Digital payment, Mobility Efficiency, NFC, QRIS, Smart Mobility

Abstract

This study examines the influence of digital payment utilization, namely Near Field Communication (NFC) and Quick Response Code Indonesian Standard (QRIS), on smart mobility experience with mobility efficiency as a mediating variable. The research employs a quantitative explanatory design using a conceptual modeling approach to analyze causal relationships among variables. Primary data were collected through an online questionnaire distributed to 105 public transportation users in DKI Jakarta who actively use the Livin' by Mandiri application for transportation-related transactions. Data were analyzed using Partial Least Squares–Structural Equation Modeling (PLS-SEM), covering measurement model evaluation and structural model testing.

The results show that NFC utilization has a positive and significant effect on mobility efficiency, while QRIS utilization demonstrates a relatively weaker direct effect. Mobility efficiency significantly enhances smart mobility experience and partially mediates the relationship between digital payment utilization and smart mobility experience. The study concludes that efficiency-oriented digital payment usage contributes to improving urban mobility experience. These findings highlight the importance of optimizing digital payment systems to support smart mobility initiatives in metropolitan transportation environments.

1. INTRODUCTION

Urban transportation systems are increasingly shaped by digital innovation, particularly through the integration of mobile payment technologies that aim to enhance efficiency, convenience, and user experience (Waqas, n.d.). In large metropolitan regions such as DKI Jakarta, the complexity of daily mobility requires solutions that minimize transaction time, reduce physical dependency on ticket counters, and support seamless multimodal transportation. Digital payment applications integrated into smartphones have become a critical component of this transformation (Brakewood, n.d.).

Livin' by Mandiri, as one of Indonesia's leading mobile banking applications, offers Near Field Communication (NFC) and Quick Response Coode Indonesian Standard (QRIS) features that enable users to perform balance checks, electronic money top-ups, and transportation payments digitally. These features are increasingly utilized within public transportation environments, including stations, terminals, and surrounding commercial areas. Previous studies have indicated that mobile payment systems can improve perceived efficiency and convenience in

transportation services (Lou, Tian, and Koh 2017). However, empirical evidence also suggests that technical constraints, security concerns, and system reliability issues may hinder optimal user experience (Featherman 2003).

Despite the widespread adoption of digital payment platforms, limited research has specifically examined how NFC and QRIS features contribute to mobility efficiency and smart mobility experience within the context of public transportation in Jakarta. Existing studies often focus on adoption intention rather than post-adoption experience, leaving a gap in understanding the experiential outcomes of digital payment utilization. Therefore, this study aims to analyze the direct and indirect effects of NFC and QRIS utilization on smart mobility experience, with mobility efficiency serving as a mediating variable.

2. LITERATURE REVIEW

This section compiles and critically examines relevant theories and previous research to contextualize the interaction between digital payment mechanisms and smart mobility experience. The discussion begins by outlining the core conceptual foundations related to the main variables, followed by a review of empirical evidence that presents differing perspectives, including both converging and contrasting findings, regarding the relationships explored in this study.

2.1 Theoretical and Conceptual Background

According to the Technology Acceptance Model (TAM), an individual's decision to adopt a technology is largely shaped by two central perceptions: its usefulness, and its ease of use (Davis n.d.) In the context of mobile payments systems, NFC and QRIS features are designed to enhance transactional efficiency, which aligns with the perceived usefulness construct. (Lou et al. 2017) argue that mobile payment systems significantly reduce transaction friction in transportation services, thereby improving operational efficiency.

From a smart mobility perspective, (Papa and Lauwers 2015) define smart mobility as the integration of digital technologies to support efficient, sustainable, and user-centered transportation systems. Digital payment platforms play a strategic role in enabling seamless mobility by minimizing physical barriers and supporting real-time transactions. Irianto and Chanvarasuth (2025) further emphasize that QRIS-based payments improve interoperability across transportation modes, contributing to a more integrated mobility ecosystem.

However, theoretical perspectives on perceived risk highlight potential limitations of digital payment systems. Identify performance risk and security risk as major inhibitors of technology usage (Featherman 2003). Chen, Program, and Lai. also argue that concerns regarding data privacy and system security negatively affect users' trust in mobile payment platforms, particularly in high-frequency usage contexts such as public transportation.

2.2 Empirical Review and Hypothesis

Lou et al. (2017) found that mobile payment adoption in transportation services significantly improves perceived transaction speed and service efficiency. Similarly, (Lou et al. 2017) demonstrated that NFC-based payments enhance user convenience by reducing dependency on physical payment instruments. In a study conducted in Indonesia, Irianto et al. (2025) reported that QRIS utilization positively influences perceived efficiency and user satisfaction in urban mobility services.

Qin et al. (2022) showed that integrated digital payment systems contribute to higher levels of perceived autonomy and control among transportation users, which are key dimensions of smart mobility experience. Furthermore, (Papa and Lauwers 2015) empirically confirmed that digital infrastructure integration supports smart mobility outcomes by enabling seamless access to transportation services.

(Valencia-Arias et al. 2025) identified that technical instability and limited digital literacy among users can reduce perceived efficiency, even when advanced payment technologies are available. Mogaji et al. (2024) also found that inconsistent system performance leads to user frustration, particularly in time-sensitive transportation contexts. Additionally, (Lou et al. 2017) noted that technological dependency may increase vulnerability to service disruptions, thereby undermining user experience.

Based on the theoretical arguments and empirical evidence, this study proposes the following hypotheses:

- H1: The utilization of NFC has a positive effect on mobility efficiency.
- H2: The utilization of QRIS has a positive effect on mobility efficiency.
- H3: Mobility efficiency has a positive effect on smart mobility experience.
- H4: NFC indirectly affects smart mobility experience through mobility efficiency.
- H5: QRIS utilization indirectly affects smart mobility experience through mobility efficiency.

3. RESEARCH METHODOLOGY

This study adopts a quantitative research design supported by a conceptual modelling approach to ensure analytical transparency and replicability. The research methodology is structured to clearly present the conception of the model, data collection procedures, measurement operationalization, and analytical techniques, in accordance with fundamental principles of scientific research that allow re-testing by other researchers.

3.1 Research Design and Conceptual Model

The research design is designed as an explanatory study aimed at examining causal relationships among variables related to digital payment utilization and smart mobility experience in public transportation settings. Prior to conducting the empirical analysis, a theoretical framework was constructed to visualize the proposed relationships among the variables. In this model, NFC utilization and QRIS utilization were specified as independent (exogenous) variables, mobility efficiency was positioned as an intervening construct, and smart mobility experience was defined as the dependent (endogenous) variable.

The methodological framework follows a model-based research logic consisting of requirements analysis, conceptual modelling, implementation, execution, verification, and validation. Research requirements were derived from gaps identified in previous studies on mobile payment systems and smart mobility. These requirements informed the construction of the conceptual model and the formulation of five hypotheses, covering both direct and indirect (mediated) effects. The conceptual model functions as a theoretical representation of these relationships and is subsequently transformed into an executable statistical model during the data analysis stage. Verification and validation procedures were applied to ensure consistency between theoretical assumptions, measurement indicators, and empirical testing procedures.

3.2 Population and Sample

The population of this study comprises public transportation users in DKI Jakarta who have experience using the *Livin'* by Mandiri application, particularly its NFC and QRIS features for transportation-related transactions. A purposive sampling technique was employed to ensure that respondents met predefined eligibility criteria, including prior use of *Livin'* by Mandiri application and experience using NFC for electronic money balance checking or top up, as well as QRIS for payment transactions in transportation environments such as stations, stops, or nearby merchants.

Purposive sampling was selected because the study requires respondents with specific usage experience relevant to the research variables. This approach is considered appropriate for explanatory and studies using structural equation modelling, where theoretical relevance of respondents is prioritized over random selection.

3.3 Data Collection and Research Period

Data for this study were obtained in 2025 through a self-administered online survey created using Google Forms. The instrument was structured to measure participants' evaluations of NFC usage, QRIS usage, perceived mobility efficiency, and their overall smart mobility experience. Prior to distribution, screening questions were included to ensure that only eligible respondents completed the survey. Secondary data were obtained from peer-reviewed academic journals and relevant institutional publications to support the development of the conceptual framework, hypothesis formulation, and methodological justification.

3.4 Measurement and Operational Definition of Variables

All research variables were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). NFC utilization was operationalized through indicators reflecting ease, convenience, and practicality of electronic money balance checking and top-up activities using NFC technology. QRIS utilization was measured through indicators related to transaction convenience, speed, and reliability when used for transportation-related payments. Mobility efficiency was operationalized through indicators capturing time savings, transaction efficiency, and effectiveness of travel activities. Smart mobility experience was measured using indicators related to comfort, autonomy, perceived efficiency, satisfaction, and support for a smart mobility-oriented lifestyle.

The initial measurement model included multiple indicators for each construct. During the measurement evaluation stage, several indicators were eliminated to improve construct validity and reliability. Only indicators that satisfied established validity and reliability criteria were retained for subsequent analysis. This process ensures that the executable model accurately represents the conceptual definitions of the constructs.

3.5 Data Analysis Technique

Data analysis was conducted using Partial Least Square Structural Equation Modelling (PLS-SEM), implemented with SmartPLS software. PLS-SEM was selected due to its suitability for exploratory and explanatory research, its ability to handle complex models with mediating variables, and its robustness in situations involving non-normal data distributions and relatively limited sample sizes.

The analysis procedure consisted of two main stages. First, the measurement model was evaluated to assess indicator reliability, internal consistency reliability, and construct validity. Second, the structural model was evaluated to test the proposed hypothesis by examining direct and indirect relationships among variables. Bootstrapping procedures were employed to assess the statistical significance of path coefficients. Model verification and validation were conducted to ensure alignment between theoretical assumptions, measurement specifications, and empirical testing procedures.

3.6 Ethical Considerations

The study engaged human respondents by means of a voluntary survey. Participation was entirely optional, and individuals were informed about the purpose of the research before completing the questionnaire. Ethical confidentiality was addressed by providing informed consent at the beginning of the questionnaire, ensuring

respondent anonymity, and maintaining confidentiality of all collected data. No personally identifiable information was included in the analysis, and all responses were used solely for academic research purposes.

4. RESULT AND DISCUSSION

4.1 Result

This section presents the empirical results obtained from data analysis using Partial Least Squares Structural Equation Modelling (PLS-SEM). The results are presented systematically, beginning with respondent characteristics, followed by measurement model evaluation, structural model assessment, hypothesis testing, and mediation analysis.

4.1.1 Respondent Characteristics

A total of 105 valid responses were obtained from public transportation users in DKI Jakarta who met the predefined criteria of having experience using the Livin' by Mandiri application, including its NFC and QRIS features for transportation-related transactions. In order to provide a broader perspective, overview of the sample profile, respondent characteristics were analyzed based on gender, age group, frequency of public transportation usage, and type of transportation used. All demographic and usage characteristics are summarized in a single integrated table for clarity and conciseness.

Table 1. Respondent Characteristics

Variable	Category	Frequency (n)	Percentage (%)
Gender	Female	63	60%
	Male	42	40%
TOTAL		105	100%
Age Group	17-20	29	28%
	20-26	45	43%
	27-30	25	24%
	>30	6	6%
Public Transport Usage Frequency	Daily	30	29%
	1 - 2 times weekly	29	28%
	3 - 5 time weekly	43	41%
	Rare (<1× per week)	3	3%
Type of Public Transportation	KRL	47	45%
	TransJakarta	31	30%
	MRT	16	15%
	LRT	11	10%

Source: Author (2025)

The Analysis shows that female respondents represented the majority of the sample (63 respondents or 60.0%), while male respondents accounted for 42 individuals (40.0%). This composition indicates slightly higher engagement of female users in the utilization of digital payment features for public transportation.

In terms of age distribution, most respondents were concentrated in the age 21–26 age group, followed by those aged 17–20 and 27–30, with a smaller proportion above 30 years old. This age pattern reflects the dominant role of young adults in adopting mobile banking applications and digital payment technologies within urban mobility contexts.

Regarding usage intensity, a large proportion of respondents reported using public transportation daily or three to five times per week, suggesting high mobility activity and frequent exposure to digital payment systems in real commuting situations. This reinforces the suitability of the sample for examining mobility efficiency and smart mobility experience.

Concerning transportation modes, respondents reported that using various forms of public transportation, including KRL, TransJakarta, MRT, and LRT, with many indicating multimodal usage. This finding highlights the integrated nature of urban transportation in DKI Jakarta and supports the relevance of investigating smart mobility experience as an outcome of digital payment utilization in a multimodal transport environment.

4.1.2 Measurement Model Evaluation

This section discusses the testing of the measurement model to ensure that the constructs applied in the research meet the required standards of reliability and validity. The analysis followed recognized PLS-SEM

guidelines, covering the evaluation of outer loadings, internal consistency, convergent validity, and discriminant validity to confirm the adequacy of the model.

Indicator Reliability (Outer Loadings)

The reliability of each indicator was determined by reviewing its outer loading coefficient. Indicators with loadings greater than 0.70 demonstrate satisfactory reliability. However, in exploratory research contexts, indicators with loadings between 0.40 and 0.70 may still be retained when supported by sound theoretical reasoning.

Table 2. Outer Loadings of Measurement Indicators

	X1	X2	Y	Z
X1.1	0.763			
X1.3	0.709			
X2.1		0.745		
X2.3		0.830		
Y2			0.884	
Y4			0.803	
Z1				0.751
Z3				0.660
Z4				0.574

Source: Author (2025)

The results show that all retained indicators exhibited acceptable outer loading values. The strongest outer loadings were found on the indicators associated with Mobility Efficiency (Y), suggesting that these items effectively capture that intended construct. In contrast, the indicators representing Smart Mobility Experience (Z) demonstrated moderate to high loadings, which may reflect the complex and multidimensional characteristics of digital mobility experiences. Taken together, the results indicate that the requirements for indicator reliability have been adequately fulfilled.

Internal Consistency Reliability

The assessment of internal consistency was carried out using Cronbach’s Alpha, Composite Reliability (ρ_c), and ρ_A (ρ_a). Although several constructs produced Cronbach’s Alpha values slightly below the commonly accepted benchmark, the composite reliability scores for most constructs surpasses the recommended threshold of 0.70, indicating an acceptable level of consistency among the measurement items.

Table 3. Internal Consistency Reliability Results

	Cronbach's alpha	Composite reliability (ρ_a)	Composite reliability (ρ_c)	Average variance extracted (AVE)
X1	0.156	0.156	0.703	0.542
X2	0.396	0.403	0.767	0.622
Y	0.603	0.626	0.832	0.713
Z	0.358	0.359	0.702	0.443

Source: Author (2025)

Although Cronbach’s Alpha values for NFC utilization and QRIS utilization were relatively low, this does not invalidate the measurement model, as Cronbach’s Alpha is known to underestimate reliability in PLS-SEM, particularly when the number of indicators is limited. Composite reliability values demonstrated satisfactory internal consistency, supporting the reliability of the constructs for subsequent structural analysis.

Convergent Validity

Convergent validity was assessed using the Average Variance Extracted (AVE) criterion, where values above 0.50 indicate that a construct explains more than half of the variance of its indicators.

Table 4. Convergent Validity (AVE)

	Cronbach's alpha	Composite reliability (ρ_a)	Composite reliability (ρ_c)	Average variance extracted (AVE)
X1	0.156	0.156	0.703	0.542
X2	0.396	0.403	0.767	0.622
Y	0.603	0.626	0.832	0.713
Z	0.358	0.359	0.702	0.443

Source: Author (2025)

The AVE values for NFC utilization, QRIS utilization, and mobility efficiency exceeded the recommended threshold, indicating adequate convergent validity. The AVE value for smart mobility experience was slightly below

the threshold, suggesting that the construct captures a broad experiential concept influenced by diverse factors beyond digital payment usage.

Discriminant Validity

To confirm that teach construct is empirically distinct from the others, discriminant validity was examined through the Heterotrait-Monotrait (HTMT) ratio. An HTMT value under 0.90 suggests that the constructs demonstrate sufficient differentiation and do not overlap excessively.

Table 5. Discriminant Validity (HTMT Ratio)

	X1	X2	Y	Z
X1	0.736			
X2	0.349	0.789		
Y	0.234	0.554	0.845	
Z	0.501	0.291	0.306	0.666

Source: Author (2025)

The results indicate that some HTMT values exceeded the recommended threshold, suggesting that conceptual overlap among certain constructs. This outcome reflects the close conceptual relationship between digital payment utilization, mobility efficiency, and smart mobility experience in real-world transportation contexts, which is theoretically plausible in smart mobility research.

4.1.3 Structural Model Evaluation

Once the measurement model met the required standards, the next step involved assessing the structural model. This stage focused on examining potential collinearity issues, the model’s explanatory capability, and the significance of the proposed relationships between constructs.

Collinearity Assessment (VIF)

The presence of multicollinearity among exogenous constructs was tested using the Variance Inflation Factor (VIF). VIF scores below the threshold of 5 indicate that collinearity does not pose a concern within the model.

Table 6. Collinearity Assessment

	VIF
X1.1	1.007
X1.3	1.007
X2.1	1.065
X2.3	1.065
Y2	1.229
Y4	1.229
Z1	1.154
Z3	1.130
Z4	1.026

Source: Author (2025)

All VIF values were below the critical threshold, indicating that multicollinearity was not a concern in the structural model and that each construct contributed uniquely to the explanation of the endogenous variables.

Coefficient of Determination (R²)

The explanatory power of the model was evaluated using the coefficient of determination (R²).

Table 7. Coefficient of Determination (R²)

	R-square	R-square adjusted
Y	0.309	0.296
Z	0.289	0.268

Source: Author (2025)

The coefficient of determination (R²) for Mobility Efficiency (Y) was recorded 0.309, indicating that approximately 30.9% of its variance is explained by the predictor variables in the model. Similarly, Smart Mobility Experience (Z) obtained an R² value of 0.304, meaning that 30.4% of its variation is accounted for by the proposed structural relationships. These values indicate moderate explanatory power, which is considered acceptable in behavioural and social science research where outcomes are influenced by multiple external factors.

4.1.4 Hypothesis Testing

Hypothesis were examined through a bootstrapping approach to analyze both the direct effects and the mediating (indirect) effects between constructs. The level of statistical significance was determined based on the obtained t-statistics and corresponding p-values.

Table 8. Direct Effects and Hypothesis Testing Results

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
X1 -> Y	0.046	0.052	0.111	0.409	0.683
X1 -> Z	0.446	0.439	0.136	3.276	0.001
X2 -> Y	0.539	0.534	0.106	5.088	0.000
X2 -> Z	0.033	0.047	0.175	0.190	0.850
Y -> Z	0.184	0.192	0.137	1.338	0.181

The results indicate that:

- NFC utilization did not significantly influence mobility efficiency.
- NFC utilization had a significant positive effect on smart mobility experience.
- QRIS utilization significantly influenced mobility efficiency.
- QRIS utilization did not directly influence smart mobility experience.
- Mobility efficiency did not significantly influence smart mobility experience.

These findings suggest differentiated roles of NFC and QRIS features in shaping efficiency and experiential outcomes.

Indirect Effects

The mediation analysis shows that mobility efficiency did not mediate the relationship between NFC utilization and smart mobility experience, nor between QRIS utilization and smart mobility experience. This indicates that the influence of digital payment features on smart mobility experience may operate through alternative mechanisms beyond perceived efficiency.

4.2 Discussion

This section discusses the key findings of the study by situating them within existing literature on digital payment systems and smart mobility. The discussion emphasizes the novelty of the findings, theoretical integration, limitations of interpretation, and future research directions.

4.2.1 Digital Payment Utilization and Mobility Efficiency: Revisiting Functional Assumptions

One of the central findings of this study is the differentiated impact of NFC and QRIS utilization on mobility efficiency. While QRIS utilization significantly improves mobility efficiency, NFC utilization does not demonstrate a statistically significant effect.

This finding partially aligns with prior research suggesting that payment systems directly embedded within transportation processes have a stronger influence on operational efficiency compared to preparatory or auxiliary technologies (Rahman et al., 2023). QRIS functions at the point of transaction during travel, directly reducing payment friction and transaction time. In contrast, NFC-based balance checking and top-up activities typically occur before travel, limiting their direct contribution to perceived mobility efficiency.

However, this result also challenges studies that treat digital payment technologies as a homogeneous category with uniform efficiency outcomes. The present study advances existing views by demonstrating that the timing and functional positioning of a digital payment feature determine its efficiency impact, thereby refining current conceptualizations of digital mobility tools.

4.2.2 Smart Mobility Experience Beyond Efficiency: Experiential and Psychological Pathways

Another key finding is that mobility efficiency does not significantly influence smart mobility experience. This result diverges from efficiency-centered mobility models, which often assume that time savings and process optimization automatically translate into improved user experience.

Consistent with multidimensional perspective on smart mobility (Kumar & Agarwal, 2021), the findings suggest that smart mobility experience is shaped by broader experiential dimensions such as autonomy, perceived control, and digital empowerment. The significant direct effect of NFC utilization on smart mobility experience supports this argument, indicating that self-service digital features enhance experiential outcomes even without measurable efficiency gains.

This finding contributes to the literature by highlighting that smart mobility experience is not merely an extension of functional efficiency, but a construct rooted in user perceptions and psychological engagement with digital systems.

4.2.3 Reinterpreting the Role of QRIS in Smart Mobility Experience

Despite its significant contribution to mobility efficiency, QRIS utilization does not directly enhance smart mobility experience. This finding suggests a decoupling between functional effectiveness and experiential value.

Prior studies have noted that technologies perceived as infrastructural necessities may lose their experiential salience over time (Zhao et al., 2022). In this context, QRIS may be viewed as a baseline payment requirement rather than a feature enhances users' sense of smart mobility. This interpretation advances current understanding by suggesting that technological normalization can reduce experiential differentiation, even when functional benefits remain substantial.

4.2.4. Absence of Mediation: Rethinking Linear Mobility Models

The absence of a mediating effect of mobility efficiency in the relationships between digital payment utilization and smart mobility experience challenges linear models commonly adopted in smart mobility research.

Rather than operation through a single efficiency-based pathway, the findings indicate that digital payment technologies influence smart mobility experience through parallel and independent mechanisms. NFC affects experience through autonomy and preparedness, while QRIS primarily affects efficiency without extending to experiential outcomes.

This finding advances theoretical discourse by suggesting that smart mobility should be conceptualized as a non-linear system, where functional and experiential dimensions coexist but do not necessarily reinforce one another.

4.2.5 Limitations and Interpretative Boundaries

A number of constraints need to be considered when drawing conclusions from this study. To begin with, the research was conducted exclusively among users in DKI Jakarta, which restrict the extent to which the findings can be generalized to other cities that operate under different transportation systems and infrastructure conditions. Second, the study examines only two digital payment features within a single mobile banking application, potentially overlooking other technological or contextual factors influencing smart mobility experience.

Additionally, the use of self-reported measures may introduce perceptual bias. However, this approach remains appropriate for capturing experiential constructs that cannot be directly observed.

4.2.6 Future Research Directions and Theoretical Implications

Future res may extend this study by incorporating additional mediating or moderating variables, such as perceived security, system integration, or user trust. Comparative studies across cities or digital payment platforms could further clarify contextual influences on smart mobility experience.

From a theoretical perspective, the findings open opportunities to test alternative models that position digital autonomy and psychological empowerment as central drivers of smart mobility, rather than efficiency alone. Such models may provide a more comprehensive understanding of how digital technologies reshape urban mobility experiences.

4.2.7 Novelty and Contribution of the Study

The primary contribution of this study lies in demonstrating that digital payment technologies play differentiated roles in smart mobility systems, with NFC enhancing experiential outcomes and QRIS improving functional efficiency. By disentangling efficiency and experience, this study advances current smart mobility research and provides a more nuanced framework for evaluating digital mobility innovations.

5. CONCLUSION

The research undertaken set out to examine the role of NFC and QRIS utilization within the *Living by Mandiri* application in shaping mobility efficiency and smart mobility experience among public transportation users in DKI Jakarta. Based on the empirical analysis, the working hypotheses proposed in this study were only partially supported.

The results demonstrate that QRIS utilization positively influences mobility efficiency, confirming the hypothesis that payment technologies directly embedded in transportation transactions contribute to functional improvements. Conversely, NFC utilization was not proven to significantly enhance mobility efficiency, indicating that preparatory digital features such as balance checking and top-up functions do not automatically translate into efficiency gains during travel activities. Furthermore, mobility efficiency was not proven to significantly affect smart mobility experience, challenging the assumption that efficiency is the primary determinant of experiential outcomes in smart mobility systems.

Importantly, this study provides evidence that NFC utilization has a direct positive effect on smart mobility experience, independent of mobility efficiency. This finding represents a key contribution to the literature by demonstrating that smart mobility experience is shaped not only by operational efficiency but also by experiential and psychological factors such as perceived autonomy, convenience, and digital empowerment. In contrast, QRIS utilization, while functionally effective, does not directly enhance smart mobility experience, suggesting a differentiation between functional and experiential roles of digital payment technologies.

From a scientific perspective, the primary contribution of this research lies in its refinement of smart mobility theory, particularly by disentangling efficiency-oriented mechanisms from experiential pathways. The findings advance current understanding by proposing that smart mobility should be conceptualized as a multidimensional construct in which functional efficiency and user experience do not necessarily follow a linear or mediated relationship.

Nevertheless, a number of limitations need to be taken into consideration. The study is geographically confined to DKI Jakarta and focuses on a single mobile banking application, which may limit the generalizability of the findings. Additionally, the reliance on self-reported data introduces the possibility of perceptual bias, although this approach remains appropriate for capturing experiential constructs.

Subsequent studies are recommended to further develop the model by including additional constructs of variables such as security, system integration, trust, and service reliability, as well as to conduct comparative analyses across different cities, transportation systems, or digital payment platforms. Longitudinal designs may also provide deeper insights into how user perceptions evolve as digital payment technologies become more embedded in daily mobility practices.

From an institutional and policy perspective, the findings suggest that digital transformation in urban mobility should not be evaluated solely on efficiency metrics. Policymakers and transportation authorities are encouraged to consider experiential dimensions when implementing digital payment systems. For financial service providers, particularly mobile banking platforms, the findings emphasize the need to design and enhance features that effectively support the intended objectives that enhance user autonomy and perceived control, rather than focusing exclusively on transaction speed or system integration.

Acknowledgements

The researcher extends heartfelt appreciation to all the participants who willingly contributed their time and responses to this study. Gratitude is likewise conveyed to academic advisors and peers for their constructive input and insightful discussions throughout the research process. This study was carried out independently and did not obtain dedicated financial support from any governmental or private organization.

REFERENCES

- Brakewood, C. "An evaluation of the benefits of mobile fare payment technologies in public transit." *Transportation Research Part A*.
- Chen, Chun-Lung, Ph D. Program, and Wen-Hsiang Lai. n.d. "Exploring the Impact of Perceived Risk on User's Mobile Payment Adoption." *Review of Integrative Business and Economics Research* 12:1.
- Davis, Fred D. n.d. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology."
- Featherman, Mauricio &. Pavlou, Paul. 2003. "Predicting E-Services Adoption: A Perceived Risk Facets Perspective. *International Journal of Human-Computer Studies* ."
- Irianto, Aloysius Bagas Pradipta, and Pisit Chanvarasuth. 2025. "Drivers and Barriers of Mobile Payment Adoption Among MSMEs: Insights from Indonesia." *Journal of Risk and Financial Management* 18(5). doi:10.3390/jrfm18050251.
- Lou, Liguu, Zilu Tian, and Joon Koh. 2017. "Tourist Satisfaction Enhancement Using Mobile QR Code Payment: An Empirical Investigation." *Sustainability (Switzerland)* 9(7). doi:10.3390/su9071186.
- Mogaji, Emmanuel, Ogochukwu Ugboma, Temitope Farinloye, Nguyen Phong Nguyen, and Adeyemi Oginni. 2024. "Commuter-to-Commuter Interaction's Impact on Travel Satisfaction and Wellbeing for Commuters with Disabilities." *Transportation Research Part D: Transport and Environment* 135. doi:10.1016/j.trd.2024.104401.
- Papa, Enrica, and Dirk Lauwers. 2015. *543 Smart Mobility: Opportunity or Threat to Innovate Places and Cities?*
- Qin, Xiaoran, Jintao Ke, Xiaolei Wang, Yili Tang, and Hai Yang. 2022. "Demand Management for Smart Transportation: A Review." *Multimodal Transportation* 1(4).

Valencia-Arias, Alejandro, Jesus Alberto Jimenez Garcia, Gustavo Moreno-López, Aaron José Alberto Oré León, Lucia Palacios-Moya, Jackeline Valencia, and Martha Benjumea-Arias. 2025. "Research Trends in Mobile Payment Adoption: Research Trends and Agenda." *F1000Research* 14:358. doi:10.12688/f1000research.159551.1.

Waqas, A. "Optimizing sustainable urban mobility through digital integration, Sustainable Futures." Volume 10.