

WHY DO CONSUMERS ADOPT NFC KEYCHAINS? THE ROLE OF TRUST AND USEFULNESS IN DIGITAL PAYMENT ADOPTION

Regina Humaningtyas Purba¹, Adnan Kasofi², Osly Usman³, Ryna Parlyna⁴

^{1,2,3,4} Universitas Negeri Jakarta, Indonesia

Email: humaningtyasregina@gmail.com¹, adnankasofi@unj.ac.id², oslyusman@unj.ac.id³, rynaparlyna@unj.ac.id⁴

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Abstract

This study investigates why consumers adopt NFC keychains as a digital payment tool by examining the role of trust and perceived usefulness within an extended Technology Acceptance Model. Using a quantitative approach with non-probability convenience sampling, 235 valid responses were analyzed through Partial Least Squares–Structural Equation Modeling (PLS-SEM). The findings reveal that perceived trust and perceived usefulness significantly influence behavioral intention. These results indicate that consumer adoption of NFC keychains is primarily driven by trust in the system and perceived practical benefits rather than usability or security considerations. The study contributes to the digital payment literature by highlighting the shifting determinants of adoption in intuitive, institutionally regulated payment innovations.

1. INTRODUCTION

The global financial landscape is shifting from traditional cash-based transactions to digital and contactless payment systems. According to NFC Forum and ABI Research (2024), more than 80% of respondents worldwide have reported using smartphones for contactless payments. Zignani and Sealy (2024) also found that smartwatches are increasingly used as an alternative device for completing such payments. In Indonesia, this transition is evident from the rapid growth of digital wallet adoption, and electronic money transactions in the country reached IDR 58.48 trillion in 2023, representing a 13.48% increase from the previous year (Muhammad, 2024). For consumers, digital payments offer several advantages, including reducing the need to carry cash, accelerating transaction speed, increasing transparency in spending, and providing secure digital records for financial accountability (Balakrishnan & Chin Lay Gan, 2023), while for governments and service providers, the adoption of digital payments enhances operational efficiency, lowers the cost of managing physical currency, facilitates data-driven policy decisions, and supports financial inclusion for underserved populations (Alrawad et al., 2023). Despite the rapid growth of digital payment systems in Indonesia, most innovations are still focused on smartphone-based e-wallets and QR code systems, whereas NFC keychains, which are small wearable devices that allow contactless transactions without requiring a screen, smartphone, or battery, are beginning to emerge as an alternative payment method. The introduction of these devices in Jakarta's public transportation, such as the All-Ride Charm MRT system, demonstrates the increasing acceptance of simplified and lifestyle-oriented payment technologies. Near Field Communication, or NFC, plays a key role in this development, as it enables short-range wireless communication within a distance of approximately four centimeters (Malarvizhi et al., 2022). OCBC Indonesia (2025) explains that NFC works by transmitting electrical signals, which the receiving device converts into usable energy to process transactions, and Heza Alfirsta (2025) adds that this process does not require any external battery power. Research indicates that consumers perceive NFC-based contactless payments as the most secure, convenient, reliable, and easy-to-use option compared to other methods, including contactless cards, QR codes, and cash (Zignani & Sealy, 2024), and QRIS Tap, an NFC-based payment solution introduced by Bank Indonesia in March 2025, allows transactions to be completed in approximately 0.3 seconds, which is significantly faster than traditional manual QR code scanning methods (Interactive QRIS, 2025).

Historically, NFC payment technology has been implemented across various physical form factors, beginning with contactless credit and debit cards embedded with NFC chips and later integrated into smartphones and mobile

devices (A. Rabaa'i & Zhu, 2021). Advances in the Internet of Things (IoT) and miniaturization have expanded NFC applications to diverse, internet-connected systems, including wearable devices such as smartwatches, bracelets, rings, badges, and personal accessories, which allow users to conduct transactions without removing cards or smartphones from pockets (Abdullah Al Mamun et al., 2023; Hayat et al., 2022). In Southeast Asia, brands like Apple Pay and Samsung Pay have introduced wearables with NFC payment capabilities, though market penetration remains limited in some countries (Hayat et al., 2022). A particularly innovative development is the NFC keychain, or NFC charm, which combines payment functionality with a practical everyday-carry accessory by embedding an NFC chip for contactless payments at NFC-enabled terminals (Luyao et al., 2022). International examples show strong consumer acceptance; in Japan, NFC keychains such as Pismo and Suica mini are widely used for public transportation and retail, favored by both locals and tourists for their functionality and design (Heza Alfirista, 2025). In Indonesia, the All-Ride Charm MRT, introduced through a collaboration between MRT Market and Tahilalat for MRT Jakarta payments, represents a similar innovation, currently available at selected stations, signaling openness to payment methods that combine practicality with lifestyle expression (Heza Alfirista, 2025). The NFC keychain offers distinctive advantages in user experience, including accessibility without needing smartphones or wallets, minimal cognitive load with a straightforward payment process (Heza Alfirista, 2025; A. Rabaa'i & Zhu, 2021), and the potential for aesthetic personalization through varied colors, shapes, and local designs that reflect user identity (Heza Alfirista, 2025). Research indicates that perceived usefulness, ease of use, lifestyle compatibility, convenience, and trust significantly influence adoption intention, and the keychain's compact and portable design may increase its appeal, especially among young adults and digital natives (Zhang et al., 2023; A. Rabaa'i & Zhu, 2021).

Despite extensive research on NFC mobile payments, cryptocurrency, e-wallets, and wearable payment devices globally, studies specifically examining consumer perceptions and adoption intentions regarding NFC keychains remain scarce, particularly in Indonesia (Gayatri et al., 2021). Most wearable payment research has focused on smartwatches and dominant systems such as Apple Pay and Samsung Pay in developed markets with high technology penetration (Hidayat-ur-Rehman et al., 2022). Frameworks like UTAUT2 and TAM have identified key determinants of adoption, including performance expectancy, effort expectancy, social influence, facilitating conditions, perceived usefulness, perceived ease of use, and perceived trust (Malarvizhi et al., 2022). However, these frameworks have not been systematically applied to NFC keychains recently introduced in Jakarta and other major Indonesian cities. Understanding NFC keychain adoption is important for multiple stakeholders: payment service providers need insights to optimize product design, user interfaces, and marketing strategies (Sembiring et al., 2022); regulators and government institutions require evidence to support policies, standardization, and adoption incentives (Interactive QRIS, 2025); and consumers need reliable information regarding the benefits, risks, and characteristics of NFC keychains to make informed decisions (Kavitha & Kannan, 2020). Given Indonesia's financial inclusion agenda and the strategic importance of digital payment innovation, investigating consumer adoption of NFC keychains is both academically and practically significant (Trianesti & Balqiah, 2025).

Several critical research gaps remain. First, most studies focus on smartphones and smartwatches, while NFC keychains, as independent, battery-free, highly portable devices with minimal user interaction, have received little empirical attention despite their distinct characteristics. Second, prior research is largely conducted in developed countries with mature digital payment ecosystems, whereas Jakarta, as a metropolitan city in a developing economy, presents unique conditions, including diverse digital literacy, evolving consumer trust in fintech, and public transportation as a primary contactless payment use case, meaning findings from developed markets may not generalize. Third, wearable payment studies often aggregate multiple devices into a single category, overlooking consumer perceptions toward newly introduced and simplified form factors like NFC keychains. As a result, empirical evidence remains limited regarding which factors functional usefulness, ease of use, perceived security, or trust most strongly drive consumer adoption intentions toward NFC keychains in Jakarta.

This research aims to analyze the factors influencing consumers' intention to adopt NFC keychains as a digital payment tool in Jakarta. Specifically, the study investigates how perceived usefulness, perceived ease of use, perceived security, and perceived trust impact behavioral intention to adopt NFC keychains for e-money transactions among Jakarta residents. By identifying the key determinants of adoption intention, this research will provide evidence-based insights for payment service providers, regulators, and policymakers seeking to promote digital payment innovation, while simultaneously advancing academic understanding of technology adoption in the Indonesian context.

2. LITERATURE REVIEW

2.1 Theoretical and Conceptual Background

Technology Acceptance Model (TAM)

The Technology Acceptance Model, developed by Davis (1989), represents one of the most influential and widely-applied frameworks in understanding user acceptance and adoption of information technology (Davis, 1989). TAM posits that technology adoption is fundamentally shaped by two primary cognitive beliefs: perceived usefulness (PU) and perceived ease of use (PEOU). According to Davis's original conceptualization, perceived usefulness is

defined as "the degree to which a person believes that using a particular system would improve their work performance," (Davis, 1989) while perceived ease of use refers to "the extent to which a person believes that using a particular system would be free of effort." These two constructs form the core drivers of behavioral intention (BI), which is the individual's intention to use a technology, ultimately translating to actual technology adoption and use behavior (Davis, 1989).

TAM's theoretical strength lies in its parsimony and empirical robustness. The model suggests a three-stage adoption process: external factors (such as system design features) trigger cognitive responses (PEOU and PU), which in turn shape affective responses (attitude toward using the technology), influencing behavioral intention and subsequent use behavior (Davis, 1989). Meta-analytical evidence confirms that both PU and PEOU have large effect sizes on behavioral intention across diverse technology contexts, including mobile and digital library systems (Ali & Nosheen Fatima Warraich, 2024). This foundational model has been extensively validated and replicated across numerous technology contexts, establishing it as a parsimonious yet powerful predictor of technology adoption (Davis, 1989).

Extensions of TAM: Incorporating Security and Trust

While TAM provides robust explanatory power for technology adoption, scholars have identified the need to incorporate additional variables reflecting contemporary concerns, particularly in payment systems where security and trust are paramount. Extended TAM models have integrated variables such as perceived security (PS) and perceived trust (PT) to better capture the nuanced factors influencing adoption in financial technology contexts (Primadineska & Jannah, 2021; Tian & Chan, 2024; Utomo et al., 2024; Salah & Ayyash, 2024).

Perceived Security is conceptually defined as the extent to which consumers believe that transactions using a particular payment system are protected from unauthorized access, fraud, and data breaches. In the digital payment context, perceived security encompasses technical protections (encryption, authentication), structural assurances (third-party certifications), and confidence in the security infrastructure (Primadineska & Jannah, 2021). Research demonstrates that perceived security significantly influences not only trust but also directly impacts behavioral intention to use electronic payment systems (Primadineska & Jannah, 2021; Utomo et al., 2024).

Perceived Trust represents the consumer's belief in the reliability, integrity, and competence of the payment service provider and the technological infrastructure supporting the payment system (Gong et al., 2019; Chandra et al., 2010). Trust in payment systems is multifaceted, encompassing: (1) cognitive trust, derived from rational assessment of the service provider's competence and reputation, and (2) emotional trust, rooted in confidence and comfort with the payment platform (Gong et al., 2019). Studies show that trust can be transferred from existing payment systems (such as web-based payments) to new ones (such as mobile payments), and that perceived trust significantly influences behavioral intention to adopt new payment technologies (Gong et al., 2019; Chandra et al., 2010).

The integration of PS and PT into extended TAM models has been empirically validated in multiple digital payment contexts. A comprehensive study on e-wallet adoption in Indonesia incorporating UTAUT2 with perceived trust and perceived security found that these variables played crucial roles in shaping users' behavioral intentions, with users prioritizing security and reliability over other factors (Aulia et al., 2025). Similarly, research on NFC mobile payments found that perceived security directly influences both trust and behavioral intention (Siagian et al., 2022), while perceived usefulness and ease of use operate alongside security perceptions to determine adoption (Zhang et al., 2023).

Application to E-Money and NFC Payment Systems

The extended TAM framework is particularly relevant for understanding adoption of digital payment systems, including e-money and NFC-based payment technologies. E-money systems, characterized as electronic representations of monetary value stored on devices and exchangeable for goods and services, operate within the broader ecosystem of cashless payment infrastructure (Utomo et al., 2024). NFC technology, functioning as the technical enabler for contactless transactions, presents a unique context where perceived usefulness (transactional efficiency and convenience), perceived ease of use (simplicity of tap-and-go interaction), perceived security (encryption and data protection), and perceived trust (in the NFC payment ecosystem) coalesce to shape adoption intention (Kumar et al., 2024; Siagian et al., 2022; Aris et al., 2022).

The NFC keychain, as a specific form factor of NFC payment technology, represents an understudied context within this broader framework. Unlike smartphone-based NFC payments (which have been extensively researched) or traditional contactless cards (which predate the rise of comprehensive TAM research), the NFC keychain is a wearable accessory specifically designed for payment functionality. Its novelty as a payment medium combined with its distinctive design, portability, and potential lifestyle integration suggests that the traditional TAM constructs (PU, PEOU) remain relevant, but their manifestation may be unique to this form factor. Furthermore, given the ongoing evolution of digital payment security standards and the Indonesian regulatory environment surrounding NFC

payments (exemplified by recent QRIS Tap initiatives), the roles of perceived security and perceived trust are particularly salient (Cindy et al., 2025).

2.2 Empirical Review and Hypothesis

Perceived Usefulness and Behavioral Intention

Extensive empirical research confirms that perceived usefulness is among the most robust predictors of behavioral intention across diverse payment technology contexts. In the meta-analysis of technology acceptance for mobile and digital libraries, PU demonstrated a large effect size when predicting behavioral intention, with consistent support across multiple studies (Ali & Nosheen Fatima Warraich, 2024). Specific to payment technologies, research on NFC mobile payments in India found that the relative advantage of NFC payments (conceptually aligned with PU) directly and significantly affects consumers' intentions to use NFC-based systems. The study noted that PU mediates the relationship between transaction speed, complexity, and intention to adopt (Kumar et al., 2024).

Further evidence emerges from studies on e-wallet adoption in Indonesia. Research on the DANA digital payment application found that perceived usefulness has a positive and statistically significant effect on behavioral intention, with a high path coefficient ($\beta = 0.928$, $t = 28.570$), indicating that users who perceive DANA as enhancing their transactional efficiency and financial management are substantially more likely to intend continued use (Utomo et al., 2025). Similar findings appear in research on GoPay, Indonesia's most widely-used mobile wallet, where perceived usefulness significantly influences behavioral intention (Ramadhan & Saputro, 2024). This consistency across multiple e-money platforms and payment technologies suggests that PU is a robust antecedent of adoption intention.

In the specific context of wearable payment devices, Al Mamun et al. (2023) investigated intention to adopt wearable payment devices (WPD) among Malaysian youth using an extended UTAUT framework. The study found that perceived usefulness significantly and positively influenced users' intention to adopt WPD (Sembiring et al., 2022). The authors emphasized that PU, alongside perceived ease of use and perceived trust, constitutes a core determinant of wearable payment adoption (Sembiring et al., 2022). This finding is particularly relevant to NFC keychains, as they represent a specific category of wearable payment devices designed primarily for transaction utility.

Taken together, prior empirical studies consistently demonstrate that perceived usefulness is a central determinant of behavioral intention across mobile payments, e-wallets, and wearable payment devices. The recurring finding that users are more likely to adopt payment technologies when they perceive tangible benefits in efficiency, convenience, and transaction performance provides a strong theoretical and empirical basis for expecting a positive relationship between perceived usefulness and behavioral intention in the context of NFC keychains. Given the functional orientation of NFC keychains as transaction-focused devices, perceived usefulness is expected to play a critical role in shaping adoption intention among Jakarta users.

H1: Perceived Usefulness has a positive and significant effect on Behavioral Intention to adopt NFC keychains as e-money devices in Jakarta.

Perceived Ease of Use and Behavioral Intention

Perceived ease of use consistently emerges as a direct and significant predictor of behavioral intention in payment technology research. The TAM meta-analysis confirmed a large effect size of PEOU on behavioral intention across library systems (Ali & Nosheen Fatima Warraich, 2024), and this pattern extends to financial technology adoption. In the NFC mobile payment study from India, ease of use though not directly influencing adoption intention in the primary analysis was identified as a critical factor when necessary condition analysis was applied, suggesting that certain levels of ease of use are essential prerequisites for adoption in growing markets (Kumar et al., 2024).

Recent research on NFC payment adoption specifically found that mobile ease of use significantly influences behavioral intention to adopt NFC payments, with this effect sometimes mediated through perceived usefulness (OCBC Indonesia, 2025). The extended TAM study on NFC mobile payments in Saudi Arabia involving 392 respondents demonstrated that mobile ease of use significantly influences behavioral intention to adopt NFC, with effect sizes comparable to or exceeding those of other variables (OCBC Indonesia, 2025). Notably, the study identified mediation pathways whereby PEOU influences BI both directly and indirectly through perceived usefulness (OCBC Indonesia, 2025).

In the Indonesian context, research on DANA e-wallet found that perceived ease of use directly and significantly affects behavioral intention ($\beta = 0.955$, $t = 154.251$), with an extraordinarily high path coefficient indicating the paramount importance of user-friendly interface design (Utomo et al., 2025). The study emphasized that users who perceive the application as facilitating easy transactions and financial management are substantially more inclined to continue using the service (Utomo et al., 2025). Similar findings appear in research on QRIS Tap

(the NFC-based QRIS variant recently launched in Jakarta), where perceived ease of use significantly influenced intention to use among existing and potential users (Cindy et al., 2025).

The relevance to NFC keychains is particularly strong here, as the tap-and-go interaction paradigm underlying NFC keychains is fundamentally designed to minimize cognitive and physical effort. The simplicity of the interaction, proximity to a terminal followed by transaction completion, aligns closely with Davis's original conceptualization of ease of use (Davis, 1989).

Existing TAM and extended TAM studies indicate that perceived ease of use exerts both direct and indirect effects on behavioral intention, either independently or through perceived usefulness. Across NFC mobile payments, e-wallets, and QRIS-based systems, ease of use has been shown to reduce cognitive effort and adoption barriers, particularly in emerging markets. Given that NFC keychains rely on a simple tap-and-go interaction with minimal user input, it is theoretically expected that higher perceived ease of use will positively influence consumers' intention to adopt NFC keychains as an e-money device.

H2: Perceived Ease of Use has a positive and significant effect on Behavioral Intention to adopt NFC keychains as e-money devices in Jakarta.

Perceived Security and Behavioral Intention

Perceived security has emerged as a critical variable in digital payment adoption, particularly in developing market contexts where security concerns remain prominent among consumers. In the extended TAM study on e-money adoption in Indonesian urban contexts (Padang City), perceived security was explicitly incorporated as a novel extension variable, and results revealed significant relationships between PS and positive attitude toward e-money, which in turn boosted behavioral intentions (Utomo et al., 2024). The study underscored that security perceptions, alongside ease of use, are primary drivers of adoption intention in urban e-money contexts (Utomo et al., 2024).

A comprehensive study examining the effects of perceived security, perceived ease of use, and perceived usefulness on consumer behavioral intention through trust in digital payment platforms found that perceived security directly affects both trust and consumer behavioral intention. The study, conducted on 250 consumers of social media-based digital payment platforms, demonstrated that PS has significant direct paths to both trust and behavioral intention, independent of other variables. Notably, perceived security also exhibits indirect effects on behavioral intention through trust and perceived usefulness, suggesting multiple pathways through which security perceptions influence adoption (Siagian et al., 2022).

In the Indonesian context specifically, research on electronic payment systems during the COVID-19 pandemic found that perceived security significantly influences the decision to use digital payment systems, with technical protection measures explicitly affecting perceptions of security (Primadineska & Jannah, 2021). The study emphasized that providers must complete and develop secure systems for users, particularly in pandemic contexts when adoption accelerates (Primadineska & Jannah, 2021). Furthermore, research on e-wallet adoption incorporating UTAUT2 found that perceived security is among the most significant factors shaping behavioral intention, with users prioritizing security and reliability over external social influences or entertainment value (Aulia et al., 2025).

For NFC keychains specifically, security perceptions encompass concerns about contactless transaction vulnerability, data interception risks, and the trustworthiness of embedded chip technology. Given that NFC keychains represent a relatively novel payment form in Indonesia, consumer security concerns are likely to be salient.

The reviewed studies consistently emphasize perceived security as a critical antecedent of adoption intention in digital payment systems, particularly in developing economies where concerns over fraud, data privacy, and unauthorized access remain salient. Empirical evidence demonstrates that users are more inclined to adopt payment technologies when they perceive transaction processes to be secure and well-protected. Given the novelty of NFC keychains in Indonesia and their contactless nature, perceived security is expected to directly influence behavioral intention to adopt this payment form.

H3: Perceived Security has a positive and significant effect on Behavioral Intention to adopt NFC keychains as e-money devices in Jakarta.

Perceived Trust and Behavioral Intention

Trust represents a foundational element in payment technology adoption, particularly for novel systems where consumers lack extensive experiential knowledge. Research grounded in trust theory demonstrates that both cognitive and emotional trust can be transferred from existing payment systems to new ones, influencing adoption intention

(Gong et al., 2019). Trust encompasses beliefs about the service provider's competence and reputation, as well as the structural assurances (technical safeguards, certifications, regulatory oversight) embedded in the payment system (Chandra et al., 2010).

Empirical studies consistently demonstrate the significant impact of trust on behavioral intention in payment contexts. A seminal study by Pavlou (2003) established the foundational relationships between trust, risk, and adoption intention, finding that trust significantly mitigates perceived risk and enhances adoption intention (Chandra et al., 2010). More recent research on mobile payment systems found that consumer trust in m-payment systems is of overarching importance compared to other technology adoption factors (Chandra et al., 2010), particularly in emerging markets where payment system familiarity is limited.

In the specific context of wearable payment device adoption among Malaysian youth, perceived trust was identified as one of the core determinants of intention to adopt WPD (Sembiring et al., 2022). The extended UTAUT study found that perceived trust significantly and positively influenced users' intention to adopt wearable payment devices, with the authors emphasizing that trust construction is essential for expanding adoption of novel payment forms (Sembiring et al., 2022). Additionally, in research examining the adoption intention of NFC mobile payment services in Malaysia, trust played a mediating and direct role in shaping adoption intention (Aris et al., 2022).

For NFC keychains in the Indonesian context, trust encompasses multiple dimensions: trust in the device manufacturer, trust in the e-money service provider, trust in the regulatory framework (particularly Bank Indonesia's oversight of payment systems), and trust in the security of the embedded NFC infrastructure. Given that NFC keychains represent a relatively new product category in Indonesia, with limited consumer familiarity, perceived trust is likely to be a significant antecedent of adoption intention.

Prior research on payment technology adoption consistently identifies trust as a foundational mechanism that reduces perceived risk and enhances behavioral intention. Trust has been shown to play both a direct and mediating role in adoption decisions, particularly for newly introduced or less familiar payment technologies. In the context of NFC keychains, where consumer experience remains limited, trust in the service provider, regulatory framework, and underlying technology is expected to be a decisive factor shaping adoption intention.

H4: Perceived Trust has a positive and significant effect on Behavioral Intention to adopt NFC keychains as e-money devices in Jakarta.

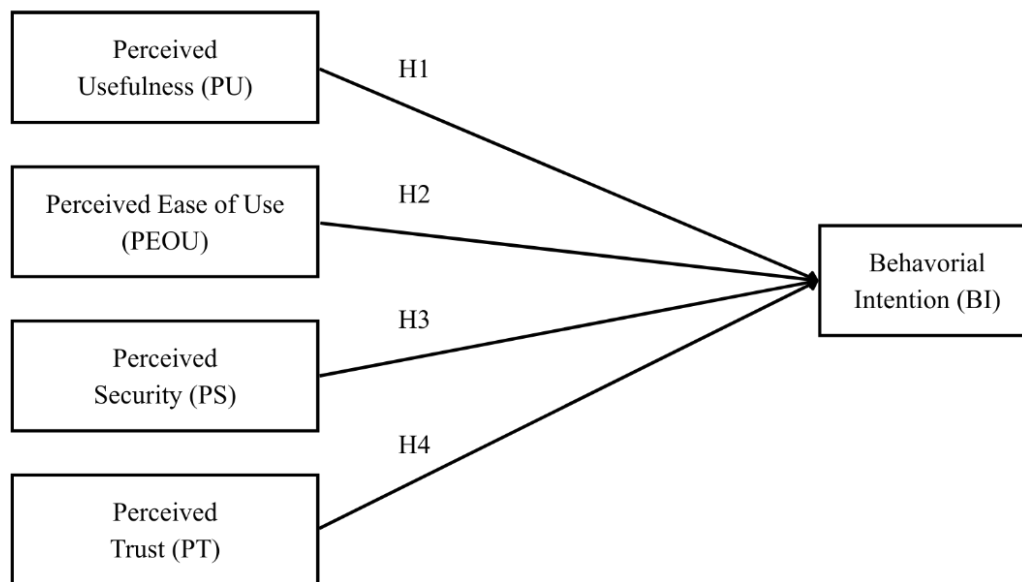


Figure 1. Conceptual Model of the Study
Source: Authors (2025)

3. RESEARCH METHODOLOGY

3.1 Research Design

This study employed a quantitative, cross-sectional survey design grounded in the Technology Acceptance Model (TAM). Within the TAM framework, perceived usefulness (PU) and perceived ease of use (PEOU) represent the core determinants of technology acceptance (Davis, 1989; Roldán & Sánchez-Franco, 2012). To enhance the

model's explanatory power in the context of digital payment technologies, the original TAM was extended by incorporating perceived security (PS) and perceived trust (PT) as additional antecedents of behavioral intention to adopt NFC keychains. Data were analyzed using variance-based Structural Equation Modeling (PLS-SEM) with SmartPLS 4.0. PLS-SEM is particularly appropriate for exploratory and prediction-oriented research, complex models with multiple latent constructs, and studies focusing on technology adoption behavior (Roldán & Sánchez-Franco, 2012).

3.2 Participants and Sampling

The study targeted adult residents of Jakarta who had experience with, or awareness of, digital payment systems. A non-probability convenience sampling approach with self-selection was employed. Participants were recruited through online distribution of the survey link via social media platforms and messaging applications. Individuals voluntarily chose to participate after being informed of the study's purpose. A total of 235 valid responses were collected and retained for analysis. All respondents met the inclusion criteria: (1) being at least 18 years old, (2) residing in Jakarta, and (3) providing informed consent prior to participation. The final sample size ($N = 235$) exceeded the minimum requirements for PLS-SEM analysis, satisfying both the "10-times rule" and more recent power-based recommendations for structural equation modeling with latent variables.

3.3 Measurement Instruments

A structured questionnaire was developed based on validated measurement scales from prior studies. Measurement items for perceived usefulness (PU), perceived ease of use (PEOU), and behavioral intention (BI) were adapted from the original TAM instruments (Davis, 1989). Items for perceived security (PS) and perceived trust (PT) were adapted from recent empirical studies on digital payment and NFC adoption. All constructs were operationalized using multiple reflective indicators measured on a five-point Likert scale ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree"). The questionnaire was pre-tested to ensure clarity, readability, and content relevance. The use of established and validated items supports content validity and consistency with prior TAM-based research.

Table 1. Measurement Items

Variable	Code	Measurement Items	Source
Perceived Usefulness (PU)	PU1	Using an NFC keychain makes payment transactions easier	Davis (1989); Zhang et al. (2023); Acosta et al. (2024)
	PU2	NFC keychains help me complete transactions faster and more efficiently	
	PU3	NFC keychains make my daily payment activities more convenient	
Perceived Ease of Use (PEOU)	PEOU1	NFC keychains are easy to learn and use	Davis (1989); Zhang et al. (2023)
	PEOU2	I find it easy to understand how NFC keychains work	
	PEOU3	Using an NFC keychain does not require much effort	
Perceived Security (PS)	PS1	I feel that my personal data is secure when using an NFC keychain	Siagian et al. (2022)
	PS2	Transactions made using NFC keychains are secure	
	PS3	I am not worried about misuse of my balance when using NFC keychains	
Perceived Trust (PT)	PT1	I trust the payment system used by NFC keychains	Siagian et al. (2022); Cindy et al. (2020)
	PT2	I believe NFC keychain service providers are trustworthy	
	PT3	NFC service providers are responsible for transaction security	
	PT4	NFC keychains are managed by professional providers	
Behavioral Intention (BI)	BI1	I am interested in using an NFC keychain as a payment tool	Davis (1989)
	BI2	I intend to use NFC keychains regularly if available	
	BI3	I would recommend NFC keychains to others	

Source: Authors (2025)

3.4 Data Analysis Method

Data analysis was conducted using SmartPLS 4.0 following the PLS-SEM procedure. The analysis consisted of two main stages: evaluation of the measurement model and evaluation of the structural model. The measurement model was evaluated to ensure the reliability and validity of the constructs. Indicator reliability was assessed through outer loadings, with values of 0.70 or higher considered acceptable. Internal consistency reliability was examined

using composite reliability (CR), where values exceeding 0.70 indicated satisfactory reliability. Convergent validity was evaluated using the average variance extracted (AVE), with a threshold of 0.50 or higher signifying adequate convergent validity. Discriminant validity was assessed using both the Fornell–Larcker criterion and the Heterotrait–Monotrait ratio (HTMT). HTMT values below 0.85 were used as the benchmark to confirm that each construct was empirically distinct from the others.

Following the assessment of the measurement model, the structural model was evaluated to test the hypothesized relationships. Collinearity among the predictor constructs was examined using the variance inflation factor (VIF), with values below 5 indicating the absence of multicollinearity issues. The structural model evaluation further involved analyzing path coefficients and their statistical significance to assess the strength and direction of the proposed relationships. The model’s explanatory power was examined using the coefficient of determination (R^2), while effect sizes (f^2) were calculated to evaluate the relative contribution of each exogenous construct to the endogenous variables. Predictive relevance of the model was assessed using the blindfolding procedure to obtain Q^2 values.

Hypothesis testing was conducted using a nonparametric bootstrapping procedure with 5,000 subsamples, in line with contemporary recommendations in PLS-SEM research. The significance of the structural paths was determined based on t-statistics and p-values. Overall, PLS-SEM was selected due to its ability to maximize explained variance, accommodate non-normal data distributions, and effectively handle complex predictive models, making it particularly suitable for technology acceptance research involving emerging payment technologies such as NFC keychains.

4. RESULT AND DISCUSSION

4.1 Result

Table 2 and 3 summarizes the demographic profile of respondents. The majority of respondents were aged between 18 and 24 years (52.3%), followed by those aged 25–34 years (20.4%) and above 35 years (20.0%). This indicates that the sample is dominated by young adults, who are generally more familiar with digital payment technologies. In terms of gender, the sample is relatively balanced, with 51.5% female and 48.5% male respondents.

Table 2. Age Distribution

Age Group	Frequency	Percentage (%)
Below 18 years	17	7.2
18–24 years	123	52.3
25–34 years	48	20.4
Above 35 years	47	20.0
Total	235	100

Source: Authors (2025)

Table 3. Gender Distribution

Gender	Frequency	Percentage (%)
Female	121	51.5
Male	114	48.5
Total	235	100

Source: Authors (2025)

4.1.1 Measurement Model Evaluation

Indicator Reliability (Outer Loadings)

Table 4. Outer Loadings

	BI.	PEOU.	PS.	PT.	PU.
BI. 1	0.957				
BI. 2	0.963				
BI. 3	0.962				
PEOU. 1		0.947			
PEOU. 2		0.938			
PEOU. 3		0.930			
PS. 1			0.966		
PS. 2			0.966		
PS. 3			0.953		
PT. 1				0.932	

PT. 2	0.961
PT. 3	0.941
PT. 4	0.955
PU. 1	0.967
PU. 2	0.946
PU. 3	0.957

Source: Output SmartPLS 4, 2025

Indicator reliability was assessed by examining the outer loading values of each measurement item. As shown in Table 4, all indicators exhibit outer loadings ranging from 0.930 to 0.967, which are well above the recommended threshold of 0.70. Specifically, Behavioral Intention items (BI1–BI3) show loadings between 0.957 and 0.963, indicating strong measurement of intention to use NFC keychains. Perceived Usefulness items load between 0.946 and 0.967, reflecting respondents' consistent perception of the functional benefits of NFC keychains. Similarly, Perceived Ease of Use, Perceived Security, and Perceived Trust all demonstrate high loadings (above 0.93), confirming that each indicator reliably represents its respective latent construct. These results indicate that all indicators meet the indicator reliability criterion and no items needed to be removed from the model.

Internal Consistency Reliability and Convergent Validity

Table 5. Construct Reliability and Convergent Validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
BI.	0.958	0.958	0.973	0.923
PEOU.	0.932	0.933	0.957	0.881
PS.	0.959	0.959	0.973	0.924
PT.	0.962	0.962	0.972	0.898
PU.	0.954	0.954	0.970	0.915

Source: Output SmartPLS 4, 2025

Internal consistency reliability was evaluated using Cronbach's alpha and composite reliability (ρ_c), while convergent validity was assessed using Average Variance Extracted (AVE). As presented in Table 5, Cronbach's alpha values range from 0.932 to 0.962, exceeding the minimum threshold of 0.70, indicating excellent internal consistency. Composite reliability values range from 0.957 to 0.973, further confirming the reliability of all constructs. In addition, AVE values range between 0.881 and 0.924, surpassing the recommended threshold of 0.50. This indicates that each construct explains more than half of the variance of its indicators. Overall, the results demonstrate strong internal consistency and adequate convergent validity for all constructs in the model.

Discriminant Validity

Table 6. Fornell–Larcker Criterion

	BI.	PEOU.	PS.	PT.	PU.
BI.	0.961				
PEOU.	0.766	0.938			
PS.	0.755	0.739	0.961		
PT.	0.853	0.805	0.865	0.947	
PU.	0.771	0.870	0.743	0.799	0.957

Source: Output SmartPLS 4, 2025

Discriminant validity was assessed using the Fornell–Larcker criterion. As shown in Table 6, the square root of the AVE for each construct (displayed on the diagonal) is higher than its correlations with other constructs. For example, the square root of AVE for Behavioral Intention (0.961) is greater than its correlations with Perceived Usefulness (0.771), Perceived Ease of Use (0.766), Perceived Security (0.755), and Perceived Trust (0.853). Similar patterns are observed for all other constructs. These results confirm that each construct is empirically distinct, and discriminant validity is satisfactorily established.

4.1.2 Structural Model Evaluation

Coefficient of Determination (R^2)

Table 7. R-square

	R-square	R-square adjusted
BI.	0.752	0.748

Source: Output SmartPLS 4, 2025

The coefficient of determination (R^2) indicates the proportion of variance explained by the independent variables. As shown in Table 7, Behavioral Intention has an R^2 value of 0.752 (adjusted $R^2 = 0.748$). This result suggests that 75.2% of the variance in Behavioral Intention to adopt NFC keychains is explained by Perceived Usefulness, Perceived Ease of Use, Perceived Security, and Perceived Trust. According to Hair et al. (2017), this represents substantial explanatory power in behavioral research.

Hypothesis Testing (Path Coefficients)

Table 8. Path Coefficients and Bootstrapping Results

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (O/STDEV)	P values
PEOU. -> BI.	0.112	0.111	0.068	1.659	0.097
PS. -> BI.	0.013	0.016	0.070	0.189	0.850
PT. -> BI.	0.611	0.612	0.077	7.917	0.000
PU. -> BI.	0.175	0.174	0.068	2.569	0.010

Source: Output SmartPLS 4, 2025

Hypotheses were tested using bootstrapping procedures in SmartPLS. The results of the path analysis are presented in Table 8. Perceived Usefulness has a positive and significant effect on Behavioral Intention ($\beta = 0.175$, $t = 2.569$, $p = 0.010$), supporting H1. Perceived Trust shows the strongest positive effect on Behavioral Intention ($\beta = 0.611$, $t = 7.917$, $p < 0.001$), supporting H4. However, Perceived Ease of Use ($\beta = 0.112$, $p = 0.097$) and Perceived Security ($\beta = 0.013$, $p = 0.850$) do not have significant effects on Behavioral Intention. Therefore, H2 and H3 are not supported.

4.2 Discussion

This study examined the factors influencing consumers' intention to adopt NFC keychains as an e-money payment tool in Jakarta using an extended Technology Acceptance Model. Overall, the results demonstrate that perceived trust and perceived usefulness are the primary drivers of adoption intention, while perceived ease of use and perceived security do not directly influence intention.

The significant effect of Perceived Usefulness on Behavioral Intention is consistent with the original TAM framework (Davis, 1989) and extensive prior research on digital and NFC-based payment systems (Zhang et al., 2023; Utomo et al., 2025). This finding suggests that Jakarta consumers are more likely to adopt NFC keychains when they perceive clear functional benefits, such as faster transactions, convenience, and efficiency in daily payments. Given that NFC keychains are positioned as practical, everyday payment accessories, their adoption is strongly linked to how effectively they improve users' transactional experience. This confirms that usefulness remains a central determinant even for novel payment form factors.

Perceived Trust emerges as the strongest predictor of Behavioral Intention in this study. This finding aligns with prior research emphasizing trust as a critical factor in adopting new payment technologies (Chandra et al., 2010; Sembiring et al., 2022). NFC keychains represent a relatively new payment medium in Indonesia, and users may lack extensive experience with this form factor. As a result, trust in the service provider, system reliability, and regulatory oversight plays a crucial role in reducing uncertainty and encouraging adoption. This finding highlights that without sufficient trust, perceived usefulness alone may not be enough to drive adoption.

Contrary to many TAM-based studies, Perceived Ease of Use does not significantly influence Behavioral Intention. A plausible explanation is the ceiling effect. The outer loadings and descriptive patterns suggest that respondents generally perceive NFC keychains as very easy to use, given their simple tap-and-go mechanism. When ease of use is uniformly high and taken for granted, it no longer differentiates users' intentions. In such cases, PEOU

may influence intention indirectly through perceived usefulness rather than directly, as suggested by prior research on mature or intuitive technologies (Kumar et al., 2024).

Perceived Security also does not significantly affect Behavioral Intention. This result may be explained by the baseline security assumption among respondents. In Jakarta, digital payment users are increasingly familiar with regulated systems such as QRIS and bank-issued e-money, which may lead users to assume that security is already guaranteed. As a result, security is perceived as a basic requirement rather than a motivating factor. Once minimum security expectations are met, users shift their focus toward trust and usefulness. This finding contrasts with studies conducted in contexts where security concerns remain salient (Siagian et al., 2022; Utomo et al., 2024), highlighting the importance of contextual factors.

Although perceived ease of use and perceived security do not exhibit significant direct effects on behavioral intention, their theoretical relevance should not be disregarded. Within the Technology Acceptance Model, perceived ease of use is often conceptualized as an antecedent of perceived usefulness rather than a direct predictor of intention, particularly when a technology is intuitive and familiar to users. Similarly, perceived security may function as a foundational condition that supports trust formation rather than acting as a standalone motivator. Therefore, the non-significant direct effects observed in this study may indicate the presence of indirect relationships, where ease of use and security influence behavioral intention through perceived usefulness and perceived trust. This finding underscores the importance of examining mediating mechanisms when applying extended TAM to mature digital payment technologies.

The measurement model results indicate very high indicator loadings and reliability values across all constructs. While this confirms strong internal consistency and construct validity, it may also suggest a degree of item redundancy, which is common in TAM-based studies employing highly standardized and well-established measurement scales. Given that all measurement items were adapted from validated instruments in prior peer-reviewed research, the high loadings likely reflect conceptual clarity and respondent familiarity with digital payment technologies rather than measurement deficiencies. Nonetheless, future studies may consider scale refinement by reducing overlapping items or employing alternative measurement approaches to enhance parsimony and reduce potential redundancy. In addition, the potential issue of common method bias should be considered, as data were collected using a self-reported questionnaire at a single point in time. To mitigate this risk, several procedural remedies were applied, including assuring respondent anonymity, minimizing evaluation apprehension, and using clearly worded and distinct measurement items. Moreover, the absence of excessively high inter-construct correlations and the satisfactory discriminant validity results suggest that common method bias is unlikely to pose a serious threat to the study's conclusions. Nevertheless, future research may incorporate statistical remedies, such as marker variables or full collinearity variance inflation factor (VIF) assessments, to further validate the robustness of the findings.

The findings suggest that promoting NFC keychains in Jakarta should focus on building consumer trust and clearly communicating practical benefits, rather than emphasizing ease of use or technical security features alone. Theoretically, this study supports the extension of TAM by incorporating trust and demonstrates that the importance of traditional TAM constructs can vary depending on technology maturity and user familiarity.

5. CONCLUSION

This study examined the determinants of consumers' intention to adopt NFC keychains as an e-money payment tool in Jakarta using an extended Technology Acceptance Model. The results indicate that perceived trust and perceived usefulness significantly influence behavioral intention, while perceived ease of use and perceived security do not have a direct effect. Theoretically, these findings extend the TAM literature by showing that for intuitive, low-effort payment innovations like NFC keychains, trust can outweigh traditional predictors such as ease of use or security, highlighting that the relative importance of adoption factors may shift depending on technology maturity, simplicity, and institutional context. From a managerial and policy perspective, fintech providers and financial institutions should prioritize building consumer trust by ensuring system reliability, provider accountability, and transparency, while clearly communicating regulatory compliance and professional management. Regulators can support adoption by strengthening certification frameworks, clarifying oversight mechanisms, and raising public awareness of protections. Moreover, user education programs and onboarding tutorials can improve self-efficacy and digital payment literacy, enhancing adoption rates. Several limitations should be acknowledged: the study employed non-probability, self-selected sampling within a single metropolitan area, limiting generalizability; it relied on cross-sectional data, capturing perceptions at one point in time; and behavioral intention was measured without direct observation of actual usage. Future research could address these limitations by conducting multi-city or cross-country

comparisons, employing probabilistic sampling where feasible, adopting longitudinal designs, and incorporating behavioral measures. Additionally, exploring mediating or moderating variables such as prior usage experience, perceived risk, or institutional trust may provide further insight into how certain constructs influence adoption. Overall, the study underscores that successful diffusion of NFC-based payment innovations depends not only on technological capability but also on institutional trust, perceived value, and effective communication to users.

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