Factors Influencing User Adoption of Mobile Payment System: An Integrated Model of Perceived Usefulness, Ease of Use, Financial Literacy, and Trust

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ABSTRACT

In the digital age, mobile payment systems have revolutionized financial transactions by offering convenience, efficiency, and security. This study aims to explore the factors influencing the adoption of the mobile payment system in Indonesia, focusing on perceived usefulness (PU), perceived ease of use (PEU), financial literacy (FL), and perceived trust (PT). Data was collected from 400 respondents using an online survey and analyzed using SmartPLS 3 software. The results indicate that PU and PEU significantly impact users' intention to use (BI) the mobile payment system, with path coefficients of 0.928 (t-value = 28.570) and 0.955 (t-value = 154.251) respectively. PEU also positively influences PU ($\beta = 0.955$, $p < 0.001$). FL was found to affect PT significantly ($\beta = 0.222$, $p = 0.006$), which in turn influences BI ($\beta = 0.068$, $p = 0.059$), although the direct effect of PT on BI was marginally non-significant. The R^2 values for BI, PT, and PU were 0.977, 0.814, and 0.912 respectively, indicating a high explanatory power of the model. This study extends the Technology Acceptance Model (TAM) by integrating FL and PT, providing a comprehensive understanding of the factors driving mobile payment adoption. The findings offer valuable insights for developers, service providers, and policymakers to enhance user experience, build trust, and improve FL, ultimately promoting higher adoption rates of mobile payment systems. Future research should consider a more diverse population and explore additional factors such as social influence and facilitating conditions to validate and extend these findings further.

INTRODUCTION

In the digital age, the landscape of financial transactions has undergone significant transformations, driven primarily by technological advancements. Mobile payment systems have emerged as a pivotal innovation, revolutionizing consumer transactions. These systems offer a convenient, efficient, and secure alternative to traditional payment methods, enabling users to make payments via their smartphones with just a few taps. As a result, mobile payments have seen widespread adoption globally, becoming an integral part of daily financial activities for millions of people. The accelerated adoption of mobile payment systems can be attributed to various factors influencing users' behavior and

preferences. One significant factor that has expedited the adoption of mobile payments is the impact of external events such as the COVID-19 pandemic. The pandemic has acted as a catalyst for the widespread adoption of mobile payments, particularly in specific sectors like e-hailing services, where mobile payments have become the preferred method due to the emphasis on contactless transactions [1].

Moreover, the adoption of mobile payments has been facilitated by the benefits it offers to users, such as increased convenience, lower transaction costs, and improved liquidity constraints. Studies have shown that mobile payment adoption can lead to higher household consumption, especially among economically disadvantaged individuals and those with lower levels of education [2]. These advantages have incentivized users to embrace mobile payment systems as a more efficient and accessible payment method. Additionally, factors such as perceived risk, self-efficacy, effort expectancy, and compatibility have played crucial roles in driving interest and adoption of mobile payment systems in various regions, including Indonesia [3], [4], [5]. The compatibility of mobile payment services with users' needs and expectations has been identified as a significant driver of adoption, as users are more likely to adopt technologies that align with their existing practices and preferences [4]. Furthermore, the role of PT has been highlighted as a critical factor influencing the adoption of mobile payments. PT in the security and reliability of mobile payment systems has been identified as a significant determinant of adoption, as users are more likely to embrace mobile payments when they perceive them as trustworthy and secure [6], [7]. Establishing PT among users and ensuring the security of transactions are essential for fostering widespread adoption of mobile payment systems.

User adoption is a critical determinant of the success and sustainability of mobile payment platforms. For these systems to thrive, they must attract a significant user base and ensure consistent engagement. This involves gaining initial users and fostering continuous usage and loyalty. Therefore, understanding the factors that drive user adoption is essential for developers, service providers, and policymakers who aim to enhance the reach and impact of mobile payment technologies. Effective user adoption strategies can lead to higher transaction volumes, more excellent customer retention, and ultimately, the financial viability of the payment system. Mobile payment platforms must address user concerns and preferences to achieve widespread adoption. These include the system's PU and PEU, the platform's PT level, and their FL, influencing their ability to navigate and utilize digital financial services effectively. By exploring these factors in depth, stakeholders can develop more targeted and practical strategies to promote user adoption and satisfaction, ensuring that mobile payment systems meet the needs and expectations of their users. In Indonesia, where the adoption of mobile payment systems is increasing, mobile payment systems have emerged as a prominent player in the market. As a digital wallet platform, the mobile payment system provides various financial services, including money transfers, bill payments, and online shopping transactions. Despite its growing popularity, there remains a need for comprehensive research to understand the specific factors influencing its adoption. This paper aims to fill this gap by examining the interplay between PU, PEU, FL, and PT in driving the adoption of the mobile payment system. Through this investigation, we seek to provide valuable insights that can inform

the development of more effective user adoption strategies for mobile payment systems and similar platforms in the digital payment landscape.

Despite the rapid growth and widespread availability of mobile payment systems, achieving widespread user adoption remains a significant challenge. One of the primary hurdles is the inherent resistance to change that many potential users exhibit. This resistance can stem from various factors, including a lack of PT in the technology, concerns over security, and the perceived complexity of using such systems. Users may fear the risk of fraud or data breaches, which can deter them from adopting mobile payment methods. Additionally, the digital divide—differences in access to and familiarity with technology—can exacerbate adoption challenges, especially among older populations or rural areas with limited internet connectivity. Another challenge is the competition within the mobile payment market. With numerous platforms offering slightly different features and benefits, consumers may feel overwhelmed by the choices and uncertain about which service to use. This fragmentation can hinder the establishment of a dominant, widely trusted platform, making it more difficult for any single system to achieve critical mass. Furthermore, integrating mobile payment systems with existing financial infrastructure, such as banking networks and retail systems, can be complex and inconsistent, leading to a fragmented user experience that may frustrate potential adopters.

Understanding the factors influencing user adoption of mobile payment systems is crucial for overcoming these challenges and achieving widespread acceptance. By identifying and addressing the key drivers of adoption, developers and service providers can design more user-centric platforms that better meet the needs and preferences of their target audience. Research in this area can provide valuable insights into how PU, PEU, FL, and PT impact the decision to adopt mobile payment systems. PU and PEU are critical components that influence user adoption. If users perceive a mobile payment system as beneficial and easy to navigate, they are more likely to adopt it. FL also plays a significant role, as users with a better understanding of economic concepts and digital tools are more equipped to use mobile payment systems effectively. PT is another pivotal factor; users must feel confident that the platform is secure and reliable to consider using it for their financial transactions. By examining these factors in the context of the mobile payment system, this study aims to shed light on the specific dynamics at play in user adoption within this market. Insights gained from this research can inform the development of strategies to enhance user experience, build PT, and ultimately drive higher adoption rates for mobile payment systems and similar platforms.

Despite the growing body of literature on mobile payment systems, existing studies have often focused on individual factors influencing user adoption. Research has examined PU, PEU, FL, and PT in isolation. For instance, several studies have highlighted how PU can drive the adoption of mobile payment technologies, emphasizing the importance of functionality and benefits perceived by the users. Other research has underscored the role of PEU, suggesting that more straightforward, intuitive interfaces can lead to higher adoption rates. Similarly, FL has been identified as a crucial factor, where users with a better understanding of financial products are more likely to engage with digital payment systems. PT, too, has been extensively studied, with findings

indicating that a secure and reliable platform can significantly influence users' willingness to adopt mobile payments.

However, these studies often fail to consider how these variables interact with each other to impact user adoption comprehensively. The lack of an integrated model means these factors' combined effects and potential interdependencies remain underexplored. Without understanding how these elements work together, developing a holistic view of what drives user adoption of mobile payment systems is challenging. This gap in the literature signifies a need for a more comprehensive approach that considers the interplay between PU, PEU, FL, and PT, providing a clearer picture of the factors influencing user BI. In the specific context of the mobile payment system, the empirical evidence on how these factors influence user adoption is minimal. While the mobile payment system has gained considerable traction in the market, detailed studies examining the integrated effects of these critical variables on its adoption are scarce. Most existing research on mobile payment systems either focuses on general market trends or specific aspects of user behavior without delving into a comprehensive analysis that includes all critical factors. This lack of targeted empirical studies leaves a gap in understanding the unique dynamics within the mobile payment system's user base. By addressing this research gap, the present study aims to contribute valuable insights into the specific factors that drive mobile payment system user adoption, offering practical implications for improving the platform and informing strategies for other mobile payment systems in similar contexts.

The primary objective of this research is to develop and validate an integrated model that elucidates the factors influencing user adoption of the mobile payment system. Given the multifaceted nature of user BI in adopting digital financial services, this study aims to combine critical variables identified in previous literature—namely, PU, PEU, FL, and PT—into a cohesive framework. By doing so, we seek to provide a more comprehensive understanding of the elements that drive user engagement and acceptance of mobile payment platforms like mobile payment systems. The integrated model proposed in this study specifically focuses on exploring the relationships between PU, PEU, FL, PT, and the BI the mobile payment system. PU pertains to the degree to which a user believes using a mobile payment system will enhance their transaction efficiency. PEU addresses the user's perception of the effort required to operate the system. FL examines the user's knowledge and understanding of economic principles that facilitate effective use of the mobile payment system. PT evaluates the confidence users have in the security and reliability of the mobile payment system. Finally, the BI is users adopt and continuously engage with the system.

This research aims to identify the direct effects of these variables on the intention to use mobile payment systems and investigate potential mediating effects among them. For instance, we hypothesize that PEU may influence PU, affecting the intention to use. Similarly, FL might enhance PT, subsequently impacting the user's intention to adopt the system. By examining these relationships, the study provides a nuanced understanding of how these factors influence user adoption. The research will offer valuable insights for developers, policymakers, and service providers by achieving this objective. It will help design more user-friendly and trustworthy mobile payment systems catering to

users' needs and preferences. Additionally, the findings can inform strategies to enhance FL among potential users, thereby fostering greater PT and adoption rates. In the context of mobile payment systems, these insights will be particularly beneficial in understanding and addressing the unique challenges and opportunities within the Indonesian market, ultimately contributing to the broader field of digital payment systems. To systematically explore the factors influencing user adoption of the mobile payment system, this research seeks to answer the following overarching question: What are the effects of PU, PEU, FL, and PT on the BI to use the mobile payment system? Addressing this question involves delving into these variables' individual and combined impacts, thereby providing a comprehensive understanding of the dynamics at play in user adoption behavior.

The first research question focuses on the relationship between PEU and PU. PEU represents the extent to which a user feels that using the system will be effort-free. Hypothesis H1 proposes that PEU influences PU. This implies that if users find the mobile payment system easy to navigate and operate, they are more likely to perceive it as valid, increasing their propensity to use it. The second research question examines the interplay between PEU and PT. Hypothesis H2 posits that PEU affects PT. This relationship suggests that when users find the mobile payment system easy to use, their PT in its security and reliability will likely be enhanced. An intuitive and user-friendly interface can alleviate concerns about potential risks, thereby fostering PT among users. The third research question explores the role of FL in shaping PT. FL involves the knowledge and understanding of economic principles and concepts, enabling users to make informed decisions. Hypothesis H3 suggests that FL positively affects PT, indicating that users with higher FL are more likely to PT the mobile payment system. This PT, in turn, can lead to greater user adoption and sustained engagement. The fourth research question examines the direct influence of PU on the BI to use mobile payment systems. PU is a critical determinant in technology acceptance models, reflecting how users believe using a particular system will enhance their performance or efficiency. Hypothesis H4 posits that PU directly affects the BI mobile payment system, suggesting that users who find the system beneficial and advantageous are more likely to adopt and utilize it consistently. The fifth research question investigates the direct effect of PT on the BI to use mobile payment systems. PT is pivotal in adopting digital payment systems, encompassing users' confidence in the system's security, reliability, and overall integrity. Hypothesis H5 asserts that PT directly influences the BI to use a mobile payment system. This hypothesis underscores the importance of PT as a mediator that can significantly impact user decisions regarding the adoption and continued use of the mobile payment system.

By addressing these research questions and testing the associated hypotheses, this study aims to provide a detailed and nuanced understanding of the factors influencing user adoption of the mobile payment system. The insights gained from this analysis will contribute to developing more effective strategies for enhancing user experience, building PT, and ultimately driving higher adoption rates for mobile payment systems and similar platforms in the digital payment landscape.

Literature Review

Mobile Payment Systems

A mobile payment system is a method of payment where transactions for goods and services are conducted through mobile devices such as smartphones, tablets, or other portable electronic gadgets connected to a mobile telecommunications network [8]. This system has become an alternative to traditional physical cash transactions and card payments [9]. It involves initiating a transaction through the mobile device and authorizing the payment to exchange goods or services [8]. Security is a critical aspect of mobile payment systems, with confidentiality, authentication, integrity, and non-repudiation essential for a secure transaction environment. Technologies like tokenization, user and device authentication, and whitebox cryptography safeguard mobile payment systems from potential threats [10]. Additionally, the integration of body area networks and fuzzy vault technology has been proposed to enhance the security of mobile payment schemes [11]. The evolution of mobile technology, especially smartphones, has facilitated the emergence of mobile payment methods, enabling users to make payments conveniently using their mobile devices [12]. These systems offer benefits such as quick and secure digital payments, catering to the increasing demand for mobile payment services [13]. Moreover, the application of mobile payment systems extends to various contexts, including online and offline payments, public transportation, and retail transactions [14].

Factors influencing the adoption and usage of mobile payment systems include user satisfaction, service quality, security concerns, and BI [15], [16], [17]. Understanding users' BI and preferences is crucial for successfully implementing and accepting mobile payment technologies. Additionally, the characteristics of mobile payment services, such as usability, risk perception, and positive psychological capital, play a significant role in shaping users' BI towards mobile payments [18], [19]. Mobile wallets allow users to store funds digitally and use them for online and offline transactions. Carrier billing enables users to charge transactions directly to their mobile phone bill, while SMS payments involve sending a text message to authorize a payment. App-based payments, which include dedicated mobile payment apps, facilitate secure transactions through the application interface. The importance of mobile payment systems has grown significantly over the past decade, driven by the rapid proliferation of smartphones and the increasing accessibility of the internet. These systems offer numerous advantages, such as convenience, speed, and security, making them an attractive alternative to traditional payment methods. They are particularly beneficial in developing countries, where they can promote financial inclusion by providing banking services to unbanked and underbanked populations. Mobile payment systems also support the digital economy by enabling seamless online transactions and facilitating the growth of e-commerce.

Growth trends in mobile payment adoption indicate a positive trajectory, with an increasing number of users globally embracing these technologies. The widespread adoption is fueled by several factors, including advancements in mobile technology, the rise of fintech companies, and changing consumer

preferences towards digital and contactless payments. The COVID-19 pandemic has also accelerated the shift toward mobile payments as consumers and businesses seek safer and more hygienic transaction methods. According to recent studies, the global mobile payment market is expected to thrive, with significant adoption rates observed in Asia-Pacific, North America, and Europe. Mobile payment systems have experienced substantial adoption in Indonesia, driven by various factors influencing user' BI. The Central Bank of Indonesia has actively promoted the adoption of cashless payment systems, including mobile wallets, since 2010 [20]. This initiative aligns with the growing trend in the e-banking and e-commerce industry in Indonesia, where mobile payments have gained popularity due to advancements in information technology, offering faster and more convenient payment services [21].

The adoption of mobile payment systems in Indonesia has been influenced by critical factors such as user satisfaction, service quality, security concerns, and BI [22], [23], [24]. With the support of improving telecommunications infrastructure and government encouragement, Indonesians have become more receptive to innovative technologies like mobile payment applications. Additionally, the COVID-19 pandemic has further accelerated the adoption of mobile payment systems in Indonesia, emphasizing the importance of contactless transactions [25]. Various mobile payment platforms have emerged in Indonesia, such as GoPay, OVO, ShopeePay, LinkAja, and Dana, catering to the diverse needs of users and contributing to the growth of mobile payment services in the country [26]. The Central Bank of Indonesia has registered numerous e-wallet mobile applications, reflecting the country's dynamic landscape of mobile payments [27]. Furthermore, the involvement of e-wallet providers and regulatory bodies in educating users about the benefits and risks of adopting e-wallets has played a crucial role in promoting financial inclusion through non-cash payment methods [28]. Studies have explored the factors influencing the adoption of mobile payment systems in Indonesia, considering aspects such as usability, perceived risk, PT, religiosity, and social influence [29], [30], [31]. These factors shape users' attitudes and intentions toward mobile payment technologies, underscoring the importance of understanding user perceptions and preferences in driving adoption.

This research focuses on the mobile payment system as its primary object of study. The respondents of this study are users of various mobile payment applications that fall into this category. Several mobile payment applications are widely used and recognized for their functionality and user base. These applications include, but are not limited to, Dana, a popular mobile payment app in Indonesia that allows users to make payments, transfer money, and pay bills. GoPay, integrated with the Gojek app, is widely used for transportation, food delivery, and other services provided by Gojek. OVO is another leading mobile payment platform in Indonesia, offering various services such as payments, transfers, and investment options. LinkAja provides users with the ability to make transactions, pay bills, and transfer money securely. ShopeePay, part of the Shopee e-commerce platform, is used for online shopping payments and various other transactions. These applications are part of the broader mobile payment ecosystem, offering various features and services to enhance user convenience and financial management.

Perceived Usefulness (PU)

PU is a core construct in the TAM, developed by [32]. It is the degree to which a person believes using a particular system or technology will enhance their performance or productivity. In the context of mobile payment systems, PU reflects how users believe these systems can improve their financial transactions' efficiency, convenience, and effectiveness. PU is considered a critical factor in technology adoption, as it directly influences an individual's decision to embrace and continuously use new technologies. The relevance of PU in technology adoption cannot be overstated. Numerous studies have demonstrated that PU significantly impacts users' attitudes towards adopting new technologies. When users perceive a system as applicable, they are more likely to develop a positive attitude towards it, which increases their BI to use the technology. This relationship has been validated across various contexts, including mobile banking, e-commerce, and online learning platforms. In each case, PU emerged as a strong predictor of user acceptance and BI to use the technology, underscoring its importance in understanding technology adoption behavior. Previous research findings consistently highlight the influence of PU on BI. For instance, a study by [33] found that PU was a significant determinant of users' intentions to use information systems, accounting for a substantial variance in BI. Similarly, studies have shown that users who perceive these systems as applicable are more likely to adopt and use them in the context of mobile payment systems. For example, a study by [34] on mobile payment adoption in Brazil identified PU as a critical factor driving user acceptance, with users prioritizing the convenience and efficiency offered by mobile payments.

In the specific context of mobile payment system, PU plays a crucial role in influencing user adoption. Users are likely to adopt the mobile payment system if they believe it can simplify their financial transactions, save time, and provide greater convenience than traditional payment methods. This PU can drive higher adoption rates, as users recognize the platform's tangible benefits. Understanding the impact of PU on BI can help developers and service providers enhance the perceived value of mobile payment system, thereby encouraging more users to adopt and regularly use the mobile payment system. By integrating the concept of PU into the study of mobile payment system's user adoption, this research aims to provide a comprehensive understanding of how PU influences the decision-making process of potential users. The insights gained can inform strategies to enhance the perceived utility of mobile payment system, making it a more attractive option for a broader user base and ultimately driving higher adoption rates in the competitive mobile payment market.

Perceived Ease of Use (PEU)

PEU is a fundamental construct in the TAM proposed by [32]. It is defined as the degree to which a person believes that using a particular system or technology will be free of effort. In the context of mobile payment systems, PEU reflects the user's perception of how simple financial transactions are. PEU is crucial in determining user acceptance of technology, as it influences users' willingness to engage with and adopt new systems. Technologies perceived as easy to use are more likely to be accepted by users, as they require less effort to learn and operate, thereby reducing the barriers to adoption. The role of PEU in determining user acceptance of technology has been extensively studied in various domains. Research consistently shows that PEU significantly impacts

users' attitudes towards technology and their subsequent BI to use it. When users find a system easy to navigate and operate, they are more likely to develop positive attitudes towards the technology, which enhances their BI to use it. This relationship has been validated across different technological contexts, including mobile banking, online shopping, and e-learning platforms. For instance, a study by [33] demonstrated that PEU directly influences users' attitudes and intentions, highlighting its importance in the technology adoption. The relationship between PEU and PU is also critical in understanding technology acceptance. According to the TAM, PEU directly affects user attitudes and intentions and indirectly influences them through PU. When users perceive a technology as easy to use, they are more likely to view it as beneficial because PEU reduces the cognitive effort required to perform tasks, enhancing the system's perceived benefits. This interrelationship suggests that improving the PEU of a technology can positively impact its PU, leading to higher adoption rates.

In mobile payment systems, PEU is a pivotal factor influencing user adoption. Users are more likely to adopt the mobile payment system if they find it intuitive and easy to navigate. The simplicity of the user interface, the ease of conducting transactions, and the clarity of instructions all contribute to a higher perception of PEU. By enhancing PEU, the mobile payment system can improve its PU, as users will see the platform as easy to use and beneficial for their financial transactions. Understanding the role of PEU in mobile payment system adoption can help developers design more user-friendly features, reducing the effort required to use the system and ultimately driving higher adoption rates.

Financial Literacy (FL)

FL refers to the knowledge and understanding of financial principles and concepts, enabling individuals to make informed and effective decisions regarding the use and management of money. This encompasses a range of skills, including budgeting, saving, investing, and understanding credit. FL is critical in mobile payments as it equips users with the skills to navigate digital financial services effectively. Users with higher FL are more likely to understand the benefits and risks of mobile payment systems, making them more adept at using these technologies. The importance of FL in mobile payments cannot be overstated. As mobile payment systems become increasingly complex, users must possess specific financial knowledge to utilize these systems effectively. FL helps users understand transaction processes, fee structures, security measures, and the overall functionality of mobile payment platforms. This knowledge is crucial for building confidence in using these systems, which drives adoption rates. Without adequate FL, users may feel overwhelmed or intimidated by the technology, leading to reluctance or refusal to adopt mobile payment systems. FL significantly affects PT in mobile payment systems and technology adoption. PT is a critical factor in the adoption of any financial technology, as it involves the user's confidence in the security and reliability of the system. Users with higher FL are more likely to understand the security features and protocols implemented in mobile payment systems, which can enhance their PT in these platforms. This understanding reduces the perceived risk of using the technology, making users more comfortable and willing to adopt mobile payments.

Several studies have demonstrated the link between FL and PT in financial

technologies. For example, research by [35] found that users with higher FL levels had greater PT in mobile banking applications, positively influencing their BI to use these services. Similarly, in mobile payments, FL can lead to a better comprehension of the system's benefits and risks, fostering PT and encouraging adoption. PT, in turn, mediates the relationship between FL and the BI to use, acting as a crucial bridge that facilitates the transition from understanding to action. In mobile payment systems, enhancing FL among users can play a pivotal role in boosting adoption rates. By providing educational resources and tools that improve users' financial knowledge, the mobile payment system can help users feel more confident using the platform securely and effectively. This confidence can translate into greater PT in the system, reducing barriers to adoption and encouraging more widespread use. Understanding the impact of FL on PT and technology adoption can inform strategies to support users in becoming more financially literate, thereby enhancing the overall user experience and promoting the adoption of the mobile payment system.

Perceived Trust (PT)

PT refers to the user's confidence in a digital financial transaction system's safety, reliability, and integrity. In mobile payment systems, PT is crucial to whether users feel secure enough to adopt and continuously use these platforms. PT encompasses several dimensions, including the belief that the system will perform as expected, safeguard personal and financial information, and handle transactions accurately and securely. PT is fundamental in digital financial transactions because it addresses users' concerns about the risks of using such technologies, including potential fraud, data breaches, and financial loss. The significance of PT in digital financial transactions cannot be overstated. PT is a psychological state that reduces online transactions' perceived uncertainty and vulnerability. It helps bridge the gap between users' expectations and the actual performance of the technology. When users PT a mobile payment system, they are more likely to engage in financial transactions through the platform, leading to higher adoption rates and sustained usage. Conversely, a lack of PT can be a significant barrier, deterring users from adopting mobile payment systems despite their perceived benefits and PEU. Several factors influence PT in mobile payment systems, each pivotal in shaping user perceptions and behaviors. Security is one of the most critical factors; users must believe that the system has robust security measures to protect their data and financial transactions. Privacy protection is another crucial element, as users need assurance that their personal information will not be misused or exposed to unauthorized parties. Reliability, or the system's ability to perform consistently and without errors, also significantly impacts PT. Finally, the service provider's reputation and previous user experiences can influence PT, as positive reviews and experiences can enhance users' confidence in the system.

Research has consistently shown that PT significantly impacts BI to use mobile payment systems. For example, a study by [36] found that PT is a critical factor influencing users' intentions to engage in online transactions, particularly in high-risk environments. In mobile payments, PT has been shown to mediate the relationship between other factors, such as PU and PEU, and the BI to use the system. This mediation effect highlights PT's role in converting positive

perceptions of the system's utility and simplicity into actual usage behavior. In the specific context of the mobile payment system, PT plays a vital role in driving user adoption. Users are more likely to adopt and continue using mobile payment systems if they PT the platform to protect their financial transactions and personal information. Building and maintaining this PT requires enhancing security features, ensuring reliable performance, and fostering a positive reputation through user feedback and transparent practices. Understanding the factors influencing PT and its impact on BI can help mobile payment systems and similar platforms develop strategies to increase user PT and promote higher adoption rates.

Intention to Use (BI)

BI to use technology is a concept rooted in various theoretical frameworks, including the Theory of Planned Behavior (TPB) and the TAM. It is defined as a user's readiness or plan to engage in a specific behavior—in this case, the adoption and use of a mobile payment system. BI to use reflects a user's cognitive representation of their willingness to perform a behavior, which is a direct antecedent to the actual usage of technology. BI is a critical predictor of whether users will adopt and regularly use a platform, such as the mobile payment system, in mobile payments. Critical determinants of BI to adopt technology include PU, PEU, PT, and FL. PU refers to how much a user believes technology will enhance performance or productivity. When users perceive a mobile payment system as applicable, they are more likely to develop a favorable attitude towards its use, increasing their intention to adopt it. On the other hand, PEU relates to the user's perception of the effort required to use the technology. If users find the system easy to use, they are more inclined to adopt it, as the lower effort reduces potential barriers to use. PT plays a significant role in shaping BI, particularly in digital financial transactions. PT involves users' confidence in the system's security, reliability, and integrity. When users PT that a mobile payment system will protect their financial information and perform transactions accurately, they are more likely to intend to use it. FL also influences BI by equipping users with the necessary knowledge and skills to understand and navigate the system effectively. Users with higher FL are more confident in using mobile payment platforms, which can enhance their intention to adopt such technologies.

Various variables influence BI, and understanding these relationships is crucial for predicting user behavior. Studies have shown that PU and PEU are directly linked to BI, with PT as a mediating variable. For instance, [33] found that PU and PEU significantly predict BI, while [37] highlighted the mediating role of PT in e-commerce adoption. Similarly, FL has positively impacted BI by enhancing users' understanding and reducing perceived complexity, as demonstrated by [38] in their study on digital banking services. In the mobile payment system context, exploring BI's determinants can provide valuable insights into user adoption behavior. By examining how PU, PEU, PT, and FL interact to influence BI, developers and service providers can design more effective strategies to enhance user engagement and adoption. Understanding these dynamics is essential for fostering a positive user experience, building PT, and ultimately driving higher adoption rates of mobile payment systems in the competitive mobile payment market.

Integrated Model

To frame our integrated model, we draw upon the theoretical foundations established by [32], and newly constructed hypotheses to understand the multifaceted role of PU, PEU, FL, and PT in influencing the adoption of the mobile payment system.

H1. PEU has a significant positive effect on PU of the mobile payment system.

The hypothesis regarding PEU suggests that the ease with which users can interact with a technology will influence their PU [32]. If users find the mobile payment system easy to use, they are more likely to perceive it as applicable. Therefore, this hypothesis posits that the mobile payment system's PEU will enhance its PU.

H2. PEU significantly affects the mobile payment system's PT.

Users' PEU with the mobile payment system also influences their PT. If the system is easy to use and users can complete transactions without difficulty, they are more likely to trust it. Therefore, this hypothesis posits that PEU will enhance PT in the system.

H3. FL significantly positively affects the mobile payment system's PT.

FL is crucial in mobile payments, as users with higher FL are better equipped to understand and PT the system. This hypothesis suggests that users with higher FL will have greater PT in the mobile payment system, as they can better assess its reliability and security.

H4. PU significantly affects BI's use of the mobile payment system.

The role of PU in technology adoption connects the user's perception of the benefits provided by the technology [32]. This hypothesis suggests that users are more likely to adopt a technology if they find it helpful in enhancing their productivity and efficiency. Therefore, this hypothesis states that the PU of the mobile payment system will significantly influence the users' BI to use it. This can assist users in improving their efficiency, reducing the time spent on transactions, and enhancing their overall financial management experience.

H5. PT significantly positively affects BI to use the mobile payment system.

PT is essential for user adoption of digital financial transactions [39]. This hypothesis states that higher PT in the mobile payment system will lead to a higher BI to use it. PT in the system's security, reliability, and privacy protection encourages users to adopt the technology.

By integrating these hypotheses, the model seeks to provide a comprehensive understanding of the factors influencing the adoption of the mobile payment system. The relationships between PU, PEU, FL, PT, and BI form a robust framework for analyzing user adoption behavior in the context of mobile payment systems. The following diagram, shown as figure 1, visually represents the hypothesized relationships among the constructs.
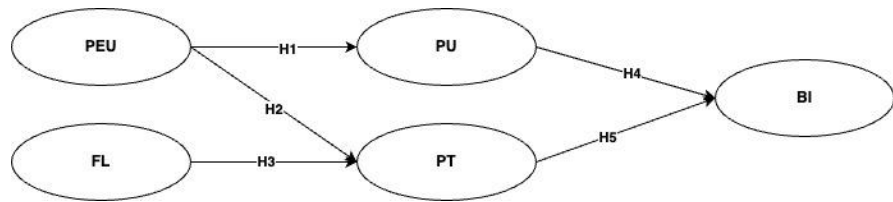
Figure 1 Research Framework

Method

To distribute the self-assessment survey, we utilized the online platform "Google Forms" to reach potential respondents within the target population of mobile payment system users in Indonesia. The survey was conducted over a period from January 2024 to February 2024. A thorough screening process was implemented to ensure the accuracy and relevance of participant responses. The criteria for selecting respondents included their experience using the mobile payment system for at least one transaction. The screening process entailed querying participants about their experience with mobile payment system, the frequency of their transactions, and their use of specific features or services offered by mobile payment system. Participants who did not meet the required experience criteria were excluded from the study. Out of the initial 420 participants, 400 qualified respondents met the screening criteria, ensuring that the sample accurately represented Indonesia's mobile payment system user base. The rationale for including users of the mobile payment system was to capture a comprehensive understanding of mobile payment adoption. Users provide valuable insights into the practical applications and impacts of the system. Demographic characteristics such as age, gender, and education level were incorporated into the research model to control for potential confounding factors. These variables enhance the robustness of the study by accounting for demographic variations that may influence the relationships between PU, PEU, FL, PT, and BI. The demographic characteristics of the respondents are detailed in Table 1. The survey was structured into two sections: the first part collected demographic information, while the second part focused on testing the hypotheses. The questions were adapted from previous research and validated scales. The validity of the questionnaire was confirmed, and a 5-point Likert scale was used to enhance measurement accuracy.

Table 1. Respondent Demographic

Characteristics	Item	Count	Percentage
Gender	Female	267	66.75%
	Male	133	33.25%
Age	18-29	70	17.50%
	30-39	76	19.00%
	40-49	79	19.75%
	50-59	84	21.00%
	60 and above	91	22.75%
Frequency of Use	Less than 6 months	85	21.25%
	6-12 months	90	22.50%
	More than 12 months	225	56.25%
Education Level	Attended University	237	59.25%
	Didn't Attended University	163	40.75%

Variance Inflation Factor (VIF) is a statistical measure used to assess the severity of multicollinearity in regression analysis. Multicollinearity occurs when there is a high correlation between independent variables, potentially leading to unreliable and inaccurate coefficient estimates and standard errors. VIF analysis evaluates the level of multicollinearity among predictor variables by calculating the variance ratio of each coefficient of an independent variable to the variance of a coefficient that would be obtained if that variable was uncorrelated with the other predictors. In this study, multicollinearity among the constructs was assessed using VIF analysis. The results showed that the inner VIF values for the constructs ranged from 1.000 to 8.907 (Table 2), indicating varying levels of multicollinearity among the latent constructs. VIF values greater than 5 indicate high multicollinearity. The VIF values suggest no severe multicollinearity among the constructs, as all VIF values are below the threshold of 10. By ensuring a robust research design and data collection process, this study aims to provide reliable and valid insights into the factors influencing the adoption of the mobile payment system.

Table 2. Inner Variance Inflation Factor (VIF) Results

Path	VIF
PT → BI	4.451
PU → BI	4.451
FL → PT	8.907
PEU → PT	8.907
PEU → PU	1.000

Result and Discussion

This study employed SmartPLS 3 software to conduct the measurement and partial least squares (PLS) analysis. Reliability and validity tests were performed during the measurement stage to ensure the constructs' consistency and accuracy. The structural model and path coefficients were then evaluated to test the relationships between the variables. This study focuses on understanding the factors influencing user adoption of the mobile payment system, particularly the relationships between PU, PEU, FL, PT, and BI. Mobile payment system aims to improve transaction efficiency and user experience, aligning with the broader trends of technology adoption in financial services. Understanding the factors influencing user adoption can provide insights into improving user engagement and satisfaction with the mobile payment system platform. This study chose the PLS-SEM method for its ability to handle complex models and its suitability for predictive analysis. PLS-SEM is ideal for exploring causal relationships among variables and managing reflective and formative measurement models. This study examines various paths and relationships among PU, PEU, FL, PT, and BI, considered complex models. A sample size of 400 was used, meeting the requirement that the sample size be five to ten times the number of paths in the model. The indicator questions used in this study are shown in Table 3 as follows.

Table 3. Questionnaire Measurement Items

Item	Questionnaire
PU, source: Adapted from [32]	
PU1	I find the mobile payment system to be a beneficial payment method.
PU2	Using the mobile payment system will increase my work efficiency.
PU3	Mobile payment system save me time.
PU4	With a vast network of agents, I can quickly visit any agent to deposit and withdraw money using the mobile payment system.
PEU, source: Adapted from [32]	
PEU1	Mobile payment system is straightforward to use.
PEU2	The mobile payment system interface is simple and easy to understand and make transactions.
PEU3	It is easy to access, register, and follow the instructions for using the mobile payment system.
PEU4	The mobile payment system can be used on any mobile phone, so 3G/Wi-Fi is unnecessary.
FL, source: Adapted from [38]	
FL1	Using the mobile payment system will be difficult if I lack financial knowledge.
FL2	A lack of financial knowledge makes it easy to be scammed and makes people reluctant to use mobile payment systems.
FL3	Repeating mobile payment system usage will help me be more confident in using mobile payment systems.
PT, source: Adapted from [39]	
PT1	I think using a mobile payment system is safer than keeping cash.
PT2	I think the mobile payment system is a reliable service with privacy protection.
PT3	I believe that mobile payment systems will always fulfill their commitments to customers.
BI, source: Adapted from [40]	
BI1	I will use a mobile payment system for mobile payments more than cash if needed.
BI2	I want to continue using mobile payment system as a regular payment method.
BI3	I think mobile payment system will have many improvements in the future.

External Model and Validation

Three main factors were assessed to evaluate the external model: reliability, concurrent, and discriminant validity. The model demonstrated strong reliability, as shown in table 4, with composite reliability values exceeding the 0.7 threshold, indicating excellent construct reliability. For concurrent validity, predictor variable loadings were above 0.5, and the average variance extracted (AVE) was also above 0.5, consistent with Fornell and Larcker's recommendations. As shown in table 5, Discriminant validity was confirmed as the factor loadings for each construct were higher than those for other constructs.

Table 4. Reliability Analysis and Convergent Validity

Construct	Item	Factor Loading	Cronbach's Alpha	Composite Reliability	AVE
BI	BI1	0.892	0.899	0.930	0.769
	BI2	0.852			
	BI3	0.837			
	BI4	0.924			
FL	FL1	0.923	0.851	0.910	0.771
	FL2	0.851			
	FL3	0.858			
PEU	PEU1	0.922	0.884	0.921	0.746
	PEU2	0.788			
	PEU3	0.802			
	PEU4	0.932			
PT	PT1	0.921	0.926	0.953	0.871
	PT2	0.943			
	PT3	0.935			
PU	PU1	0.896	0.897	0.929	0.766
	PU2	0.841			
	PU3	0.835			
	PU4	0.925			

Table 5. Discriminant Validity

Construct	BI	FL	PEU	PT	PU
BI	0.877				
FL	0.978	0.878			
PEU	0.959	0.942	0.864		
PT	0.885	0.872	0.899	0.933	
PU	0.988	0.976	0.955	0.881	0.875

Inner Model Results and Hypothesis Testing

The proposed hypotheses were rigorously tested using a PLS model. The results, presented in Table 6 and Figure 2, provide strong evidence supporting the validity of the proposed hypotheses. The data illustrate the statistical significance of the relationships between variables, with path coefficients, p-values, and t-values confirming the hypothesized effects. The results showed significant positive relationships between PEU and PT ($\beta = 0.691$, $p < 0.001$), PEU and PU ($\beta = 0.955$, $p < 0.001$), and PU and BI ($\beta = 0.928$, $p < 0.001$). The relationship between FL and PT was also significant ($\beta = 0.222$, $p = 0.006$). However, the relationship between PT and BI was not substantial ($\beta = 0.068$, $p = 0.059$).

Table 6. Hypothesis Testing Results

Hypothesis	Path	Path Coefficient	t-value	Results
H1	PEU → PU	0.955	154.251	Supported
H2	PEU → PT	0.691	9.105	Supported

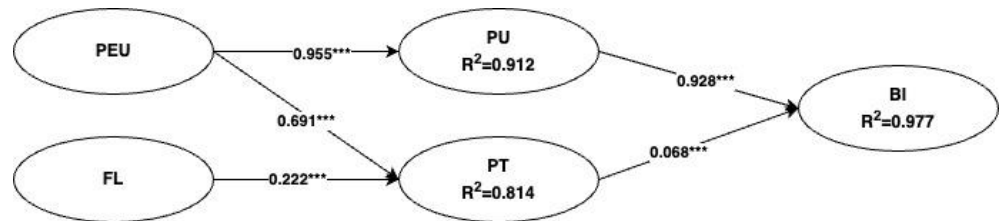| Hypothesis	Path	Path Coefficient	t-value	Results
H3	FL → PT	0.222	2.751	Supported
H4	PU → BI	0.928	28.570	Supported
H5	PT → BI	0.068	1.894	Not Supported

Figure 2 Inner Model Results Framework

Testing for Mediating Effects

To assess the role of mediating variables, we conducted the Sobel test to determine the significance of the mediation effects, as shown in table 7. Specifically, we examined the mediation effect of PU between PEU and BI. The Z-value for the Sobel test is approximately 28.55. This value is greater than the critical value of 1.96, indicating that the mediation effect of PU between PEU and BI is statistically significant at the 0.05 level. Next, we examined the mediation effect of PT between FL and BI. The Z-value for the Sobel test is approximately 1.62. This value is less than the critical value of 1.96, indicating that the mediation effect of PT between FL and BI is not statistically significant at the 0.05 level. Lastly, we examined the mediation effect of PT between PEU and BI. The Z-value for the Sobel test is approximately 1.85. This value is slightly less than the critical value of 1.96, indicating that the mediation effect of PT between PEU and BI is not statistically significant at the 0.05 level.

Table 7. Mediation Testing Results

Construct	Construct Relationship	t-value of Path Coefficient	Sobel Test
PEU → PU → BI	PEU → PU	154.251	28.55
	PU → BI	28.570	
FL → PT → BI	FL → PT	2.751	1.62
	PT → BI	1.894	
PEU → PT → BI	PEU → PT	9.105	1.85
	PT → BI	1.894	

Discussion

This study significantly advances existing literature by shedding light on the intricate relationships between PU, PEU, FL, PT, and BI in the context of the mobile payment system. The findings contribute to the theoretical foundations of these concepts and reveal their interconnections. Specifically, this study underscores the importance of understanding how these factors collectively influence the adoption of mobile payment systems. Moreover, the results emphasize that successful adoption is closely linked to increased user

satisfaction and BI to use, as evidenced by the strong positive effects of PU and PEU. By elucidating these connections, this study provides a nuanced and comprehensive perspective on the implications of these factors that extend and enrich current academic discourse. This study significantly advances the understanding of mobile payment systems' PU, PEU, FL, PT, and BI concepts. The results emphasize the need for a deep understanding of these factors influencing user adoption. As discussed in this paper, PU highlights the necessity for mobile payment providers to ensure their systems are considered beneficial and time-saving. Theories on PEU emphasize the importance of creating intuitive and simple interfaces. FL is crucial as it impacts users' confidence and willingness to engage with the system. The role of PT underscores the importance of security and reliability in fostering user confidence and subsequent BI. Together, these theories clarify the central role of these factors in determining the success of mobile payment systems, including critical metrics such as adoption rates and user satisfaction.

This research provides valuable insights for the academic community and significant managerial implications. These findings indicate that effective user adoption strategies for mobile payment systems can positively influence user satisfaction and BI to use. In other words, the more mobile payment systems like mobile payment systems are designed to be helpful, easy to use, and trustworthy, the better the user adoption outcomes. This implication is crucial for business practitioners, highlighting that enhancing PU, PEU, FL, and PT can influence user adoption. Therefore, companies should consider these factors to improve their systems. For example, companies must provide comprehensive and transparent information about their security measures to increase consumer PT. Additionally, designing user-friendly interfaces and offering educational resources to improve FL can maximize perceptions of PEU and PU. These factors are essential in management strategies to facilitate successful user adoption. This study has broader implications in social contexts. With the significant increase in mobile payment system usage, understanding its impact on user adoption is crucial. The research results provide essential information for companies to make informed decisions regarding the design and promotion of their systems. From the researcher's perspective, these findings illustrate that effective system design and implementation can provide benefits through higher user satisfaction and increased BI to use. Therefore, companies have significant opportunities to optimize the benefits of mobile payment technology to meet or even exceed their users' expectations. This study also has social impacts in terms of increasing the public understanding of mobile payment systems and their contribution to creating value for businesses and customers. As these technologies expand, the public's awareness of their benefits has become increasingly important. The results reaffirm that mobile payment systems are highly effective tools for facilitating transactions and enhancing user experiences.

The practical implications of this study are paramount for companies aspiring to enhance user adoption of mobile payment systems. This study unequivocally demonstrates that effective system design, focusing on PU, PEU, FL, and PT, positively influences user satisfaction and BI to use. As companies navigate the dynamic landscape of mobile payment system implementation, understanding the key factors affecting successful adoption becomes imperative. This study identified critical determinants, including PU, PEU, FL, and PT. This information

empowers business practitioners to formulate strategic adoption plans that consider technological aspects and address consumer PT, user experience, and education. To capitalize on the benefits of mobile payment systems, companies should prioritize building PT among users through transparent educational initiatives. Additionally, designing user-friendly interfaces and leveraging educational resources can enhance perceptions of PEU and PU, attracting consumer interest. These practical insights pave the way for companies to tailor their management strategies to ensure a seamless and successful adoption process.

Conclusion

This study explored the factors influencing user adoption of the mobile payment system by developing and validating an integrated model that included PU, PEU, FL, and PT as critical determinants of BI. The findings confirmed that PU and PEU significantly impact users' BI to use the mobile payment system, with PU having the most substantial effect. PEU also significantly influenced PU, highlighting the importance of creating a user-friendly interface. FL was found to positively affect PT, which in turn influenced BI, though the direct effect of PT on BI was marginally non-significant. This study contributes to the literature on technology adoption by integrating PU, PEU, FL, and PT into a single model. It extends the TAM by incorporating FL and PT, thus providing a more comprehensive understanding of the factors influencing mobile payment system adoption. The research highlights the importance of PT and FL in technology adoption, offering new insights into these factors' role in mobile payments. For practitioners, the study provides valuable insights into improving user adoption of mobile payment systems like mobile payment system. Companies should focus on enhancing their systems' PU and PEU by designing intuitive interfaces and providing clear usage instructions. Additionally, increasing users' FL through educational initiatives can help build PT and confidence in the system. Transparent communication about security measures is essential to foster PT and encourage adoption. This study has several limitations that should be addressed in future research. The sample was limited to users in Indonesia, which may affect the generalizability of the findings. Future studies should include a more diverse population to enhance generalizability. Additionally, while the study included key variables, other factors such as social influence and facilitating conditions could be explored. Longitudinal studies are recommended to examine changes in user adoption over time. Understanding the factors that influence the adoption of mobile payment systems is crucial for their successful implementation and widespread use. This study highlights the significant roles of PU, PEU, FL, and PT in driving mobile payment system user adoption. By addressing these factors, companies can enhance user satisfaction and increase the adoption rates of their mobile payment systems. The findings of this study provide a robust foundation for academic researchers and practitioners aiming to understand and improve the adoption of mobile payment technologies.

Declarations

Author Contributions

Conceptualization: F.S.U., N.S., and M.S.A.; Methodology: N.S.; Software: F.S.U.; Validation: F.S.U., N.S., and M.S.A.; Formal Analysis: F.S.U., N.S., and

M.S.A.; Investigation: F.S.U.; Resources: N.S.; Data Curation: N.S.; Writing—Original Draft Preparation: F.S.U., N.S., and M.S.A.; Writing—Review and Editing: N.S., F.S.U., and M.S.A.; Visualization: F.S.U. All authors have read and agreed to the published version of the manuscript.

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The data presented in this study are available on request from the corresponding author.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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