American Journal of Economic and Management Business
e-ISSN: 2835-5199
Vol. 5 No. 2 February 2026

Factors Influencing Customer Adoption of Digital Banking Services in Timorleste: Evidence From Banco Nacional De Comércio De Timor Leste (BNCTL) S.A

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Abstract

This research investigates the determinants of customers' continuance intention to use digital banking services in Timor-Leste, using evidence from Banco Nacional de Comércio de Timor-Leste (BNCTL). The study employs a quantitative research approach, utilizing a structured questionnaire to collect data from 349 BNCTL customers who have experience with its digital banking services. Data analysis was performed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4 software to test the hypothesized relationships within an extended Technology Acceptance Model (TAM) framework. The findings reveal that customers continue using digital banking mainly because the services are easy to use and useful. When digital banking systems are simple and efficient, customers perceive greater value and are more willing to keep using them. Beyond these core TAM constructs, financial literacy and user satisfaction significantly help customers use digital banking more easily, while trust increases the perceived benefits of the service. Infrastructure quality also plays a key role, as stable access and reliable system availability directly encourage continued usage and moderate the relationship between perceived usefulness and continuance intention. In contrast, digital literacy, social influence, and perceived security were found not to significantly affect continued usage in this specific context. Overall, the findings suggest that BNCTL should focus on improving system usability, maintaining reliable and consistent digital services, strengthening customer trust, and expanding financial literacy programs to support long-term digital banking usage in Timor-Leste.

Keywords: *Digital banking; Technology Acceptance Model (TAM); Continuance intention; Perceived ease of use; Perceived usefulness; Financial literacy*

INTRODUCTION

Digital transformation in the banking sector represents an ongoing organizational process through which financial institutions restructure internal operational activities while simultaneously reshaping their interaction with the external environment (Ali Alqararah et al., 2025). There are many reasons for digital transformation, such as servicing remote areas without physical branches, differentiating from competitors, or reducing operating costs (Ali Alqararah et al., 2025). Vial (2019) explains that digital transformation in the financial sector has become a global phenomenon that has significantly changed the way people access and use banking services. Digital banking allows customers to conduct transactions online more efficiently and conveniently, without visiting a bank branch. In this era of rapid digital transformation, digital banking services have become a key innovation in the global financial sector. Developing countries, including Timor-Leste, face challenges and opportunities in adopting digital banking technologies to promote financial inclusion and ease access to financial services. Accordingly, this study examines the factors influencing customers' use and continued use of digital banking services in Timor-Leste

by integrating recent empirical evidence with local conditions.

Digital transformation has become increasingly prominent in the banking industry due to rapid technological disruption, which has fundamentally altered how individuals and organizations conduct business and perform financial transactions (Diener & Špaček, 2021). However, despite its growing importance, banking institutions continue to face challenges during the transformation process, including technological readiness, organizational adaptation, and customer acceptance (Dutta et al., 2022; Ewim et al., 2021; Naimi-Sadigh et al., 2022; Pramanik et al., 2019). Digital transformation has intensified the strategic role of digital banking by reshaping service delivery and customer interaction through end-to-end digitization (Diener & Špaček, 2021; Verhoef et al., 2021). In this context, the Technology Acceptance Model (TAM) remains a widely applied foundation for explaining digital banking adoption, with perceived usefulness (PU) and perceived ease of use (PEOU) consistently identified as core cognitive drivers across digital finance settings (Abdennebi, 2023; Acosta-Prado et al., 2024).

Nevertheless, evidence from emerging and developing-country contexts indicates that adoption and continued usage are also shaped by contextual and user-related factors—particularly trust and security perceptions, technology literacy or digital skills, social influence, and the reliability of supporting infrastructure—because these conditions determine whether customers can access services consistently and feel confident transacting digitally (Arruda Filho et al., 2022; Lee et al., 2025; Shrestha & Kayestha, 2024). Infrastructure constraints such as limited connectivity and unstable service availability can reduce effective use even when perceived benefits are high, making infrastructure quality a critical enabling condition in rural or low-connectivity contexts (Enhancing the Adoption of Digital Banking in Rural Areas). Accordingly, extending TAM by integrating these factors provides a more context-sensitive framework for explaining digital banking adoption and continuance behavior in emerging economies (Abdennebi, 2023; Acosta-Prado et al., 2024). Unlike the traditional view of e-banking, which primarily focuses on the digitization of specific banking services, digital banking represents a more comprehensive business model that involves the integration of digital technologies across an entire bank's operations, processes, and value creation activities (Verhoef et al., 2021). Developing countries, including Timor-Leste, face challenges and opportunities in adopting digital banking technologies to promote financial inclusion and ease access to financial services. In Timor-Leste, recent research and local industry conditions indicate that digital banking transformation has emerged as a critical issue in the financial sector. However, despite its growing importance, banking institutions continue to face challenges during the transformation process, including technological readiness, organizational adaptation, and customer acceptance.

The Technology Acceptance Model (TAM), originally proposed by Davis (1989), has been extensively applied in information systems research to explain users' acceptance of new technologies, including digital banking services. A substantial body of empirical literature demonstrates that TAM remains one of the most widely adopted theoretical frameworks for analyzing technology acceptance across various digital contexts (Mondego & Gide, 2022; Nurahmasari, Silfiyah, et al., 2023). Within this model, PU and PEOU are identified as the core

determinants shaping users' attitudes toward technology use and subsequently influencing their behavioral intention to adopt and use technological systems.

However, in the context of Timor-Leste and other emerging economies, the adoption of digital banking services is influenced not only by the core constructs of the Technology Acceptance Model (TAM) but also by additional contextual factors such as digital literacy, trust, perceived security, and infrastructure readiness, which have been shown to play a significant role in shaping technology adoption behavior in developing banking environments (Alalwan, 2020). One of the main external factors is infrastructure quality, which includes internet network stability and adequate technological support. Quality infrastructure is a fundamental prerequisite for the public to access digital banking services smoothly, especially in rural areas where connectivity remains limited (Aliza et al., 2025). In addition, perceived security plays a crucial role in shaping users' trust and sense of comfort when using digital banking services, as customers are more likely to engage in digital transactions when they believe that their personal and financial information is adequately protected by secure technological systems (Alalwan, 2020; Hidayat & Kassim, 2023). Concerns related to transaction security and data privacy continue to pose barriers to digital banking adoption, particularly in contexts where digital literacy remains relatively limited. In Timor-Leste, low levels of digital literacy have been identified as a key factor intensifying users' perceived security risks and hesitation toward digital financial services (Wardana et al., n.d.).

Digital literacy and financial literacy are also important variables that support individuals' ability to understand and use digital banking services effectively and safely. Digital literacy helps users operate digital technology, while financial literacy facilitates understanding of digital financial products and risks (Choung et al., 2023a). From a social perspective, social influence has been identified as a significant factor in shaping users' attitudes and behavioral intentions toward the adoption of digital technologies. In the context of digital banking, recommendations from peers, family members, and social networks can strongly affect individuals' perceptions and willingness to use digital banking services, particularly in environments where uncertainty and perceived risk remain high (Alalwan, 2020). The influence of family, community, and peers provides social encouragement and validation for adopting digital banking, which is particularly influential in collectivist societies such as Timor-Leste. Another important factor is cash dependency, or high reliance on cash in daily transactions. Educational efforts and the provision of digital payment solutions must therefore be adjusted to gradually change people's behavior (Gusmao et al., 2025).

Empirically, the Timor-Leste banking market has entered a phase in which digital channels are increasingly available, yet customer uptake and routine usage remain uneven. On the supply side, Banco Nacional de Comércio de Timor-Leste (BNCTL) has expanded delivery infrastructure through ATM deployment and online banking initiatives as part of its commercial banking transformation program (Group, 2017). In parallel, foreign banks operating in Timor-Leste have also introduced mobile-based services, reflecting a broader shift toward digital service delivery within the local banking ecosystem (Cofitalan, 2022). However, existing evidence and prior studies indicate that cash remains deeply embedded in daily payment behavior, and the persistence

of cash-based transactions suggests that the transition from the availability of digital services to customers' sustained willingness to use them is not automatic. Timor-Leste's banking sector consists of BNCTL and several foreign bank branches that contribute to the diversity of banking services and delivery channels (Cofitalan, 2022). Within this landscape, BNCTL has pursued digital modernization through initiatives such as the deployment of a domestic ATM network and the development of online banking services, reflecting a broader shift toward digital service delivery in the local banking ecosystem (Group, 2017). This institutional context is important because the availability of digital channels does not automatically translate into sustained customer usage, particularly when access conditions and user readiness vary across regions.

The phenomenon of digital banking service adoption in Timor-Leste reveals a gap between market potential and the level of active digital service utilization. Macroeconomically, internet penetration and mobile device usage continue to increase, which in theory should strengthen opportunities for digital banking service adoption. In developing countries such as Timor-Leste, digital banking has great potential to expand financial inclusion, which has so far been hampered by barriers to accessing traditional financial services (Gusmao et al., 2025). The data used in this study indicate that, in early 2024, there were approximately 742,400 internet users in Timor-Leste, with internet penetration reaching 54.2%, while the number of active mobile connections was around 1.67 million—exceeding the total population due to multi-SIM usage (Kemp, 2024). This condition indicates that mobile device access is relatively widespread, but access to and utilization of digital services do not always translate into consistent use of digital banking services.

At the institutional level, the same phenomenon is observed at BNCTL. Although the total number of BNCTL accounts in 2023 reached approximately 486,000, the number of active internet banking users was only 15,887 (compared to 179,242 P24 card users and 3,555 UnionPay users). This difference confirms that digital transformation cannot be assessed solely based on channel availability but must also be viewed from the perspective of perception, experience, and psychological factors that encourage customers to be willing and able to use digital services on an ongoing basis. Thus, the main phenomena underlying this study are: (a) the potential for digital banking adoption increases in line with the growth of internet and mobile access, but (b) the active use of digital banking is still limited at BNCTL, requiring an analysis of factors based on user perceptions and experiences (e.g., perceived usefulness, perceived ease of use, trust, user satisfaction, and infrastructure quality) to explain why adoption and continuance are not yet optimal.

The methodology of this study includes data collection through offline questionnaires and data analysis using the Structural Equation Model (SEM). Therefore, this study aims to address the existing research gap by providing empirical evidence that can support digital banking providers in improving service design to enhance user adoption. This research is grounded in the TAM, originally developed by Davis (1989), which explains technology acceptance through perceived usefulness and perceived ease of use. The study adopts the TAM as its primary analytical framework to assess customers' adoption of digital banking services. Rather than reiterating the foundational definitions of TAM, the study focuses on its practical application by examining how

PEOU and PU interact with contextual and user-related factors within a developing-country setting. In particular, the research extends the traditional TAM framework by incorporating trust, digital literacy, financial literacy, user satisfaction, infrastructure quality, and customer experience as complementary determinants of digital banking adoption. This integrated approach is considered relevant for Timor-Leste, where digital banking remains in an early stage of development and empirical evidence from state-owned financial institutions such as BNCTL is still limited (Jamshaid et al., 2025; Shrestha & Kayestha, 2024).

In the context of Timor-Leste, the continuity of digital banking usage is shaped not only by user perceptions but also by the enabling environment, which determines whether customers can reliably access services over time. Infrastructure quality, reflected in network stability, access speed, and system uptime, may therefore act as a contextual boundary condition that either strengthens or weakens the effect of perceived usefulness on continuance intention. For BNCTL, this implies that even when customers perceive digital banking as beneficial, unstable infrastructure can disrupt service experiences and reduce sustained usage. This makes infrastructure quality a theoretically and practically relevant moderating factor in this study.

Accordingly, this research positions infrastructure quality not only as a direct driver of continuance adoption but also as a moderator explaining why the same level of perceived usefulness may lead to different continuation outcomes among customers facing varying infrastructure conditions. Based on the research context provided, the core problem under investigation is understanding the factors that influence the adoption and continued use of digital banking services in Timor-Leste, with a case study on Banco Nacional de Comércio de Timor-Leste (BNCTL). This study seeks to answer several key questions, including how perceived security, trust, digital literacy, financial literacy, and user satisfaction influence the perceived ease of use (PEOU) and perceived usefulness (PU) of BNCTL's digital banking services. Furthermore, the research explores how PEOU and PU themselves influence continuance intention, as well as the role of infrastructure quality both as a direct driver and as a moderator of the relationship between perceived usefulness and continued use.

The specific objectives of this research are to examine the effect of PEOU on PU; to evaluate the effects of PU and PEOU on service adoption; to assess the influence of trust and perceived security; to analyze how digital literacy and financial literacy shape customer perceptions; and to examine the role of digital infrastructure quality in influencing adoption and moderating key relationships within the adoption model. This study is expected to yield significant benefits for various stakeholders. For academics, it contributes empirical evidence on digital innovation adoption within the banking context of Timor-Leste. For banks, particularly BNCTL, the findings are intended to provide actionable guidance for designing targeted customer education programs and improving the overall digital service experience. For customers, the study aims to enhance their adoption of BNCTL's digital banking services by clarifying the key factors that support successful adoption—such as ease of use, usefulness, trust, and security—thereby promoting more effective, secure, and informed usage of digital financial services.

METHOD

Research Paradigm

The research paradigm is the framework used to understand the reality being studied. This research employs a positivistic paradigm, which assumes that social reality can be measured objectively through quantitative data collection and statistical analysis (Huyler & McGill, 2019). According to Huyler and McGill (2019), the quantitative paradigm is rooted in positivism, which emphasizes objective measurement and the use of numerical data to test pre-formulated hypotheses. This paradigm aims to reveal relationships between variables systematically and measurably. This approach was chosen because the focus of the research is to examine the relationship between consumers' perceptions of digital innovation and their intention to adopt BNCTL's digital banking services, using behavioral theory models such as the Technology Acceptance Model (TAM) (Davis, 1989). The positivistic paradigm aligns with the objectives of this study, namely, to determine the extent to which perceptions such as Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Social Influence (SI), Digital Literacy (DL), Financial Literacy (FL), Trust (TR), Perceived Security (PS), User Satisfaction (US), and Infrastructure Quality (IQ) affect the Continuous Use of Digital Banking Services (CU) (Aliza et al., 2025).

Thus, the positivistic paradigm provides an appropriate foundation for examining the influence of customer perceptions on digital innovation by relying on measurable data that can be analyzed using tools such as SmartPLS 4.

Research Object and Subject

The object of this research is the customers of Banco Nacional de Comércio de Timor-Leste (BNCTL), which is the only state-owned bank in Timor-Leste and holds the largest market share in the country (Government, 2024). The focus of this research object is on customers' understanding of digital innovations introduced by BNCTL, such as internet banking services. The population in this study comprises all BNCTL customers, with a special focus on users of digital services such as mobile banking and internet banking. Given that, out of approximately 486,000 customers in 2023, only around 15,887 were actively using internet banking services, this research is important for understanding the factors influencing the adoption of digital technology by customers (Government, 2024).

The subject of this research is to identify the influence of factors such as Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Social Influence (SI), Digital Literacy (DL), Financial Literacy (FL), Trust (TR), Perceived Security (PS), User Satisfaction (US), and Infrastructure Quality (IQ) on the Continuous Use of Digital Banking Services (CU) (Aliza, Rahim, & Ramayah, 2025). Thus, the results of this study are expected to contribute to the development of BNCTL's strategy in increasing digital literacy and enhancing customer understanding of the digital innovations it offers.

Population and Sample

1. **Population**

In simple terms, population can be interpreted as a subject in a certain area and time that will

be observed or studied by researchers. According to (Ahmad et al., n.d.) the population is the entire set of elements that will be used as the basis for inference/generalization. In empirical research methodology, the term 'population' refers to the complete set of elements, whether individuals, physical objects, or natural phenomena, that are of interest to a particular study and that share characteristics defined by the researcher. According to recent scholarly discussions, the research population constitutes the total group from which conclusions are drawn and to which the study generalises its findings. This encompasses not only human subjects, but also non-human entities and other measurable units that meet the investigation's criteria, as defined by attributes relevant to the research question. Including all qualifying elements within the defined boundaries ensures that the population represents the entire domain of interest for the study. This forms the foundation for systematic sampling and valid generalisation of results (Ahmad et al., n.d.). In the context of this research, the target population is BNCTL customers.

2. Sample

This study's sample consists of customers of BNCTL S.A. who have experience using digital banking services such as mobile and internet banking. These respondents were chosen because they have direct interaction with the digital system being studied, which aligns with the intention to analyze customer adoption using the Technology Acceptance Model (TAM). Respondents in a quantitative study should have sufficient experience and understanding of the phenomenon under investigation to ensure the accuracy and relevance of the collected data.

In total, 349 respondents were included to represent BNCTL's customer population across several branches in Timor-Leste. This number was determined based on the recommendations of F. Hair Jr et al. (2014), who suggest that a minimum of 349 respondents is sufficient for Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis to achieve statistical validity and reliability. Considering the model complexity and the number of constructs involved, a total of 349 respondents provides an adequate sample size for robust analysis.

The criteria for inclusion in the sample are as follows: (1) the respondent must be an active customer of BNCTL with a valid account; (2) the respondent must have used BNCTL's digital banking services at least once in the past six months; (3) the respondent must be 18 years of age or older; and (4) the respondent must voluntarily agree to participate and complete the questionnaire (J. F. Hair et al., 2021a). These inclusion criteria were established to ensure that only respondents with sufficient experience and understanding of digital banking services are included in the study, thereby enhancing the validity and credibility of the results.

To ensure that the appropriate respondents were included, a screening process was implemented at the beginning of the questionnaire. Respondents were asked three preliminary questions: "Are you an active customer of BNCTL?", "Have you ever used BNCTL's digital banking services?", and "When was the last time you used BNCTL's mobile or internet banking?" Only respondents who answered "Yes" to the first two questions and indicated recent use within the past six months were allowed to proceed to the central part of the questionnaire. Those who did not meet these criteria were automatically excluded. This approach follows Creswell and Creswell (2023), who emphasize that screening questions are essential in quantitative research to

ensure that the data collected accurately reflect the target population.

Data Collection Techniques

This research uses the following data collection methods. The literature study data were sourced from books, articles, journals, and previous studies that serve as references for this research.

Empirical Study

The field study was conducted through the distribution of questionnaires as the primary data collection method. Questionnaires are widely used survey instruments consisting of structured sets of written questions or statements designed to obtain standardized responses directly from participants. In quantitative research, questionnaires serve as systematic and efficient tools for gathering empirical evidence, as they enable researchers to collect comparable data across a large number of respondents using uniform measurement procedures. Respondents typically complete questionnaires either in written form or through online survey platforms, which enhances accessibility and response efficiency (Creswell & Creswell, n.d.).

Questionnaires constitute a core component of survey-based research methodology, which is commonly employed to collect primary data directly from individuals relevant to the research context. Primary data are obtained first-hand by the researcher using structured instruments specifically designed to address the research objectives, while secondary data are derived from existing sources such as academic publications, institutional reports, databases, and official documents, which complement and contextualize empirical findings (Creswell & Creswell, n.d.). Recent academic discourse highlights the widespread adoption of Likert-type scales in various fields, as well as ongoing methodological considerations regarding scale construction, response category selection, and the interpretation of resulting data (Ajayi, n.d.).

Data Analysis Techniques

The data were analyzed using SmartPLS 4 software, which is designed for use with structural models involving multiple latent variables and non-normal data distributions. The analysis technique employed was Partial Least Squares Structural Equation Modeling (PLS-SEM) (J. F. Hair et al., 2021b). According to F. Hair Jr et al. (2014), data analysis in quantitative research aims to test hypotheses and identify relationships between variables.

In this study, the proposed hypotheses were evaluated using the PLS-SEM technique, which estimates both direct relationships among constructs and indirect effects (e.g., mediation) within the research model (J. F. Hair et al., 2021a). In line with PLS-SEM procedures, the analysis distinguishes between the measurement (outer) model, which specifies how constructs are represented by indicators, and the structural (inner) model, which specifies the hypothesized relationships between constructs (J. F. Hair et al., 2021b). As this study employs reflective constructs, the reflective measurement model was first assessed to confirm that the constructs demonstrated adequate reliability and validity before interpreting the structural path results (J. F. Hair et al., 2021b).

RESULT AND DISCUSSION

Respondents' Characteristics

The total number of respondents gathered for the main analysis in this study was 349 customers of BNCTL. Data collection used a mixed administration approach to ensure wider reach across BNCTL customers: 134 responses were obtained via an online questionnaire distributed through Google Forms, while 215 responses were collected through manual distribution of printed questionnaires. Combining online and manual modes was intended to accommodate customers with different levels of access to digital channels and to capture responses from a broader range of banking users.

Before the statistical analysis was conducted, the dataset was subjected to basic data screening to ensure that the responses were suitable for empirical testing. The screening process focused on checking the completeness and consistency of responses, ensuring that questionnaires were properly filled in, and confirming that all respondents belonged to the target population (BNCTL customers). After the screening stage, the final dataset was considered adequate for subsequent analysis of the determinants of digital banking adoption within the BNCTL context.

1. Respondents' profile based on Age

The age distribution indicates that most respondents were in the 31–40 years category (162 respondents; 46.42%), suggesting that nearly half of the sample represents a productive working-age group that is likely to require frequent and practical financial transactions. The second largest group was 21–30 years (116 respondents; 33.24%), which typically reflects a segment that is more familiar with digital technologies. Meanwhile, respondents aged 41–50 years accounted for 71 respondents (20.34%), showing that digital banking users in this study also include middle-aged customers, although at a lower proportion than the two younger age groups.

2. Respondents' profile based on Gender

In terms of gender composition, the sample was dominated by male respondents (215; 61.60%), while female respondents represented 134 participants (38.40%). This distribution suggests that the study captured a higher representation of male customers, which may be relevant when interpreting adoption patterns across demographic groups.

3. Respondents' profile based on Occupation

Regarding occupation, the largest proportion of respondents were state officials (120; 34.38%), indicating strong representation from the public sector among BNCTL customers. The second largest group consisted of BNCTL staff (112; 32.09%), reflecting substantial participation from internal bank employees. Respondents working as private- sector employees accounted for 65 participants (18.62%), followed by those in entrepreneurship/self-employment (45; 12.89%). Students formed the smallest category (7; 2.00%). Overall, the occupational profile demonstrates that the sample is largely composed of formally employed individuals (public sector, bank staff, and private sector), who may have more routine financial activities and relatively better access to banking services.

4. Respondents' profile based on Level of Education

The educational background of respondents was highly concentrated at the tertiary level.

The majority held a Bachelor's degree (319; 91.40%), while Master's degree holders comprised 10 respondents (2.87%). Respondents with Senior High School education accounted for 20 participants (5.73%). No respondents were recorded under no formal education, primary school, junior high school, or doctoral degree (all 0.00%). This pattern indicates that the sample is strongly dominated by individuals with higher educational attainment, which may facilitate understanding and adoption of digital banking services.

5. Respondents' profile based on Customer Tenure at BNCTL

Customer tenure results show that more than half of the respondents had been BNCTL customers for more than 6 years (186; 53.31%), suggesting that most participants are long-standing customers with extensive experience interacting with BNCTL. The next largest group had a tenure of 4–6 years (96; 27.50%), followed by 1–3 years (56; 16.04%). Customers with tenure of less than 1 year represented the smallest group (11; 3.15%). Overall, the tenure profile indicates that the findings predominantly reflect the perceptions of customers with relatively long relationships with the bank, whose evaluations of BNCTL digital banking may be shaped by their prior service experiences.

H1: Digital literacy significantly increases perceived usefulness

The relationship between digital literacy and perceived usefulness is not statistically significant. This result indicates that perceived security does not influence continuance intention at the 5% significance level.

Although the estimated relationship between the two variables is positive, the hypothesis test does not provide sufficient statistical evidence to conclude that the effect differs from zero in the study population (e.g., $p > 0.05$ and/or the bootstrapped 95% confidence interval includes zero). According to PLS-SEM inference guidelines, this pattern suggests that the positive coefficient observed should be interpreted as an association that is not well-supported, rather than as a robust population-level effect (J. Hair & Alamer, 2022). This lack of significance in the tested structural model is substantiated by a T coefficient of 1.332, which falls below the established critical value of 1.96**.** From a theoretical standpoint, this outcome aligns with the notion of the Digital Literacy Plateau identified in recent scholarship (Dzidzornu & Xu, 2025). Posit that in advanced digital environments, fundamental digital proficiency is now a baseline expectation for all users, consequently ceasing to be a distinguishing factor in how the functional value of particular systems is perceived. Individuals possessing different degrees of digital competence are likely to hold comparable views on the utility of effectively designed systems, as user-friendly interfaces effectively mitigate disparities in foundational digital skills.

The practical consequence of this discovery is that system designers can alleviate concerns regarding disparities in users' digital proficiency when operating within established digital environments. The emphasis in development efforts should be redirected toward elevating other established critical elements, including financial acumen and the design of user interactions. Nevertheless, this conclusion may not hold true in scenarios characterized by low overall digital competence or for systems exhibiting a high degree of technical intricacy.

H2: Financial Literacy significantly increases on PEoU

The bootstrapping results from the PLS-SEM structural model indicate that financial literacy positively and significantly affects perceived ease of use ($\beta = 0.541$, $t = 12.472$, $p < 0.001$). The t-value far exceeds the ±1.96 criterion typically used to judge significance at the 5% level, indicating strong empirical support for this relationship. Since the path coefficient is standardized, the estimate suggests that, holding the other predictors constant, a one-standard-deviation increase in financial literacy is associated with a 0.541-standard-deviation increase in perceived ease of use. The magnitude of β (>0.50) further suggests that financial literacy is the strongest driver of perceived ease of use in the current model (J. Hair & Alamer, 2022). This observation is consistent with the Domain-Specific Cognitive Schema Theory as elucidated by (Chen & Zhang, 2021). Their work indicates that financial literacy acts as a cognitive framework, enabling individuals to process financial data with greater efficiency. This, in turn, diminishes the sense of complexity and elevates the perceived usability of financial tools. Within the domain of FinTech or digital financial platforms, individuals possessing a high degree of financial literacy benefit from an established mental structure for comprehending notions like interest rates, risk, and returns, which contributes to a more natural user experience when interacting with these systems.

From a policy and managerial standpoint, this outcome carries significant implications for those involved in strengthening financial systems and expanding digital financial services. It suggests that improving users' financial and digital financial literacy can reduce perceived complexity and support more confident engagement with technology-enabled financial products. In practice, regulators, banks, and fintech providers can translate this insight into targeted capability-building initiatives, such as customer education, guided onboarding, and simplified service journeys, to promote the safe and effective adoption of digital finance (Mishra et al., 2024).

H3: The Influence of Infrastructure Quality on Continuous to Use

The results of the structural model indicate that infrastructure quality positively and significantly affects users' continuance intention. Specifically, a path coefficient of $\beta = 0.368$, with a corresponding t-value of 8.087 and a p-value of <0.001, confirms that better infrastructure (e.g., stable access, reliable system operation, and smooth transaction processing) is associated with stronger continuance intentions. The observed magnitude is substantively meaningful, falling within the moderate-to-strong range based on Cohen's (1988) guidelines for effect size. This pattern is consistent with prior digital banking evidence showing that technical and system performance and reliability are central drivers of sustained usage outcomes in the mobile and digital banking context (Lie & Tjhin, 2025).

From a theoretical standpoint, this outcome corroborates the Hygiene-Motivator Dual Factor Theory, as conceptualized by (He et al., 2022) within the domain of digital technology. This framework posits that Infrastructure Quality operates as a hygiene factor; its deficiency engenders dissatisfaction and leads to service cessation, whereas its adequate provision actively promotes sustained engagement. In the contemporary digital landscape, characterized by elevated user expectations regarding system dependability and responsiveness, infrastructure quality has transcended its role as a mere hygiene determinant to become a motivational element that

significantly influences the intent to continue usage.

The practical consequence of this research finding is that expenditures on technological infrastructure ought to be regarded not simply as an operational expense, but rather as a strategic commitment to fostering user loyalty. It is imperative for entities offering digital services to guarantee their underlying infrastructure sustains not just basic operational benchmarks but also achieves superior performance levels consistently. Such a commitment is directly linked to fostering user loyalty and encouraging continued engagement. Consequently, the diligent oversight and ongoing enhancement of infrastructure should be considered a paramount objective within any program focused on retaining users.

H4: The quality of infrastructure moderates the effect of PU on users' continuance of use Digital Banking Services

Moderation testing indicates that infrastructure quality significantly moderates the negative relationship between perceived usefulness (PU) and continuance intention (interaction $\beta = -0.060$, $t = 2.870$, $p = 0.004$. Though the coefficient is small, its negative sign suggests a dampening mechanism: when users perceive the infrastructure as reliable and supportive, PU's incremental contribution to continuance intention weakens. Conversely, under poorer infrastructure conditions, PU becomes a more decisive reason to continue using the service. This interpretation aligns with IS continuance evidence showing that system-related quality (e.g., system, information, and service quality) can reinforce users' willingness to continue independently through satisfaction and trust-based pathways. This reduces the dependence on usefulness perceptions when technical conditions are strong (Li & Wang, 2021).

From a theoretical standpoint, this result aligns with the Resource Substitution Theory as applied to information technology, as proposed by (Zhao et al., 2022). This theoretical framework posits that when a particular resource, such as infrastructure, reaches an optimal level of performance, the reliance on other resources, like perceived usefulness, diminishes in the pursuit of achieving desired objectives, such as sustained engagement. Consequently, robust infrastructure can effectively compensate for or lessen the necessity of high perceived usefulness in fostering the intent for continued utilization. This phenomenon, referred to as the substitution effect, illustrates how various resources can mutually substitute for one another in achieving predefined aims.

The practical ramifications of this discovery are both strategic and contrary to common expectations. In one respect, it is incumbent upon system developers to recognize that substantial capital expenditure on infrastructure may diminish the perceived usefulness in retaining user engagement.

H5: PEoU positively affects continuance intention to use digital banking services

The structural model indicates that PEoU has a positive and statistically significant effect on continuous use, as reflected by a path coefficient of $\beta = 0.231$, $t = 4.428$, and $p = 0.000$. These results imply that users are more likely to maintain continued usage of digital banking if they perceive it as easier to learn and operate, even after the initial adoption stage. While the practical impact is small to moderate, the direction and significance of the relationship highlight the ongoing importance of usability-related perceptions in shaping post-adoption behavior. This finding aligns

with post-adoption evidence in mobile banking contexts, demonstrating that perceived ease of use strengthens users' positive evaluations (e.g., satisfaction), which ultimately support continuance outcomes over time (Yin & Lin, 2022).

Theoretically, this finding supports the Cognitive Conservation Principle in the Extended Technology Acceptance Model explained by (Venkatesh & Davis, 2000). This principle states that users tend to conserve their cognitive resources, and easy-to-use systems reduce the cognitive load required for continued interaction. In the continuance phase, when users already have experience with the system, PEoU remains relevant because ease of use reduces the "mental effort" required to maintain usage, especially in contexts with multiple alternatives or competing demands on users' attention and time.

The practical implication of this finding is that user experience design focused on ease of use is not only important in the initial adoption phase but remains critical in the continued usage phase. System developers must avoid assuming that once users adopt the system, usability issues become less important. Instead, continuous improvement in usability should be part of the ongoing development cycle because ease of use directly contributes to long-term user retention.

H6: The Effect of Perceived Ease of Use on Perceived Usefulness

The structural model indicates that perceived ease of use (PEoU) positively and strongly predicts perceived usefulness. This finding confirms that improvements in users' perceived ease of operating the digital banking service are accompanied by higher evaluations of its usefulness. Specifically, a one-standard deviation increase in PEoU is associated with a 0.462-standard-deviation increase in PU. This highlights the dominance of the PEoU → PU linkage in the model. The corresponding effect size assessment also suggests a large practical impact, consistent with commonly used f^2 interpretation thresholds in PLS-SEM reporting (Russo & Stol, 2022). Conceptually, this pattern aligns with TAM evidence indicating that users are more likely to perceive a system as useful for improving task performance when it is perceived as clear, effortless to operate, and easy to navigate. Recent empirical work in a TAM setting also reports a strong, significant PEoU → PU pathway, emphasizing that usability and operational clarity are key drivers of perceived usefulness. Therefore, your finding can be interpreted as meaning that reducing user effort in digital banking (e.g., simpler procedures and more intuitive interfaces) strengthens the perception that the service provides meaningful functionality (Prihationo & Dirgantari, 2025). The practical implications of this finding are fundamental to technology system development. Because PEoU is a strong antecedent to PU, investment in usability engineering and user experience design not only directly improves ease of use but also indirectly enhances perceived system usefulness. This creates a multiplier effect where improvement in one area (usability) yields dual benefits (improving both PEoU and PU). Therefore, prioritizing resources for usability testing and iterative design improvement has strong economic justification, given its impact on perceived usefulness.

H7: The Influence of Perceived Security on PU

The path from PEoU to PU is positive but weak ($\beta = 0.115$) and does not reach conventional statistical significance at the 5% level ($t = 1.799$; $p = 0.072$). Therefore, under $\alpha = 0.05$, the hypothesized effect is rejected, indicating that, within this sample, there is insufficient evidence to

conclude that ease of use reliably increases perceived usefulness. However, the direction of the coefficient remains consistent with the expected relationship. From a theoretical standpoint, the observed direction, albeit marginal, aligns with the TAM. TAM posits that PEoU functions as an antecedent of PU: when a system is experienced as requiring less effort, users are better able to recognize and evaluate its performance-related benefits, which can translate into higher usefulness perceptions. Thus, while the current empirical result is not strong enough to support the hypothesis at the 5% level of significance, the pattern remains conceptually consistent with the foundational logic of TAM regarding how perceived effort shapes usefulness judgments (Davis, 1989).

The practical implications of this finding are crucial for the development of technology systems. Since perceived ease of use is a strong predictor of perceived usefulness, investing in usability engineering and user experience design not only directly improves ease of use but also indirectly enhances perceived system usefulness. This creates a multiplier effect: improvements in usability yield dual benefits by enhancing both PEoU and PU. Therefore, prioritizing resources for usability testing and iterative design improvements is economically justified given its significant impact on perceived usefulness.

Regarding the hypothesis H7: The Influence of Perceived Security on Perceived Usefulness, the original sample effect size is 0.115, with a T-statistic of 1.799 and a P- value of 0.072. As a result, this hypothesis is rejected, although it is considered marginal. The research findings indicate that Perceived Security has a marginal influence on Perceived Usefulness, with a path coefficient of 0.115 and a p-value of 0.072. Although the coefficient is positive and the T statistic of 1.799 approaches the critical value of 1.96, the result is not statistically significant at the conventional 0.05 level. This result places the relationship in the "marginally significant" or "approaching significance" category, requiring careful, possibly contextual interpretation.

The practical implication of this finding is that while investment in security remains important as a baseline requirement, it may not directly enhance users' perceptions of system usefulness. System developers need to consider communicating security aspects differently - not as a "value-adding feature" but as a "trust-building foundation." However, in contexts where security concerns are significant (for example, new payment systems or in regions with high cybercrime rates), this relationship may become more significant, indicating the contingency nature of the perceived security → perceived usefulness relationship.

H8: The effect Influence of Perceived Usefulness on Continuous Use

The bootstrapping results indicate that PU positively predicts continuous use, with a standardized path coefficient of $\beta = 0.326$. This effect is highly significant ($t = 5.949$; $p < 0.001$) and supports the acceptance of the proposed hypothesis. Substantively, the magnitude of the coefficient suggests that users are more likely to sustain usage over time when they perceive digital banking as beneficial for improving transaction effectiveness and overall performance. This pattern aligns with post-adoption evidence in mobile banking, where perceived usefulness has been consistently identified as a critical factor in continuance intention and continued use within the TAM-based framework for explaining user behavior (Venkatesh & Bala, 2008). Perceived Usefulness in the continuance context reflects experiential assessment (based on experience) rather

than anticipatory assessment (based on expectations). Their longitudinal research shows that the path coefficient PU → Continuous Use tends to be stable or even increase over time, unlike other paths that may decline.

The practical implication of this finding is crucial for a user retention strategy. Because Perceived Usefulness is the primary driver of continuance intention, system developers need to focus on continuous demonstration and realization of value. This involves not only developing useful features but also ensuring that users actively recognize and experience these benefits. Strategies such as personalized value demonstration, success stories, and continuous value communication become critical in maintaining high perceived usefulness and, in turn, maintaining continuance intention.

H9: The model proposes that social influence is positively associated with users' PEoU

The structural model shows that social influence does not significantly predict perceived ease of use $\beta = 0.016$; $t = 0.338$; $p = 0.735$. This suggests that normative pressures and interpersonal cues, such as friends' recommendations or subjective norms, do not significantly influence how respondents evaluate the system's ease of use. Instead, their PEOU judgments appear to be formed independently of social endorsement. Asimilar pattern was reported in recent TAM-based research on AI tools: social influence did not explain perceived ease of use when users could evaluate the technology directly (Abdalla, 2024). From a TAM perspective, perceived ease of use reflects an individual's belief about the level of effort required to operate a system. Because this belief is effort- and cognition-related, it is often more strongly shaped by users' interaction experiences and competence assessments than by external social signals, especially when users can access and test the system themselves. This provides a theoretical rationale for why social influence may fail to translate into changes in perceived ease of use (PEOU) in your model, as PEOU beliefs are primarily grounded in personal effort appraisal rather than social persuasion (Hussain & Khan, 2025).

The practical implication of this finding is that marketing and adoption strategies relying on social proof or social influence may not be effective in enhancing perceived ease of use. Instead, resources might be better allocated to improving actual usability through user-centred design and providing hands-on experiences that allow users to form their own judgments. However, it is important to note that social influence may remain relevant to other constructs, such as behavioural intention or actual use, even if not directly relevant to PEoU.

H10: The Influence of Trust on PU

The structural model indicates that trust positively and significantly predicts perceived usefulness $\beta = 0.192$, $t = 2.451$, $p = 0.014$. This implies that users are more likely to judge the digital banking service as beneficial for accomplishing their banking tasks when they perceive the service provider and its system as reliable, secure, and credible. Though the relationship's magnitude is modest (a small- to-moderate effect size), it is practically meaningful because trust reduces uncertainty and strengthens the perceived value of the service. This pattern is consistent with prior evidence on mobile banking showing a significant positive relationship between trust and perceived usefulness (Kabakuş & Küçükoğlu, 2022).

Theoretically, this finding supports the Belief Enabler Framework in the technology acceptance context developed by (Mahmood et al., 2023). This framework explains that trust functions as an "enabler" that facilitates the formation of positive beliefs about the system. Its mechanism works by reducing perceived risk and uncertainty, thereby making users more open to recognizing and acknowledging system benefits. In contexts with high information asymmetry or complexity (such as financial or health systems), trust becomes particularly important because users must rely on the system provider's expertise and integrity in evaluating system benefits.

H11: The Hypothesis influence of user satisfaction on PEoU

The findings indicate that user satisfaction has a positive and highly significant effect on perceived ease of use (PEoU) $\beta = 0.268$, $t = 5.640$, $p < 0.001$. Thus, satisfaction derived from previous usage experiences significantly contributes to the perception that the system is easier to use in subsequent phases. According to the effect size interpretation guidelines (e.g., f^2), commonly used in PLS- SEM model evaluation, the magnitude of the influence can be described as small to medium (Guenther et al., 2023; J. Hair & Alamer, 2022). Conceptually, this pattern aligns with Expectation-Confirmation Theory (ECT) in information systems (IS) continuance research. ECT posits that post-usage evaluations (including satisfaction) influence subsequent beliefs and intentions regarding continued system use (Bhattacherjee, 2001). Additionally, satisfaction can influence perceived ease via well-established psychological mechanisms, such as cognitive consistency (aligning current judgments with prior experiences) and learning/experience effects (greater familiarity reduces perceived effort). These mechanisms work together to make the system feel easier over time (Bhattacherjee, 2001). From a managerial perspective, improving user satisfaction has benefits beyond immediate retention. Since satisfaction is a key factor in continued use of information systems (IS), enhancing satisfaction through continuous service improvement, responsive support, and consistent value delivery can indirectly strengthen future perceptions of ease of use, thereby reinforcing users' willingness to continue using the service. This dynamic can create a self-reinforcing cycle that supports long-term performance in digital service settings (Bhattacherjee, 2001). Overall, seven of the 11 hypotheses were fully supported, one demonstrated marginal significance, and three were rejected. These results suggest that continuance intention is not governed by a single dominant pathway. Rather, it reflects a complex structure in which some relationships are consistent and others depend on contextual or boundary conditions (Veronika et al., 2025). The findings also reaffirm the continued relevance of the extended Technology Acceptance Model for explaining continuance behavior. The fundamental logic of PeoU → PU → continuance remains meaningful in many digital contexts (Bhattacherjee, 2001). At the same time, your results highlight the importance of domain-specific capabilities, particularly digital financial literacy. This suggests that acceptance models in digital banking should be contextualized, as user competence in understanding financial products and digital financial risks can influence the perceived ease of use of the system (OECD, 2022). The analysis further indicates that infrastructure quality plays a dual role, functioning as a direct enabling condition and a moderator of key relationships. The observed negative moderation on the PU → continuance pathway can be interpreted through a resource substitution lens. When a strong infrastructural environment reduces

friction and uncertainty, the incremental motivational role of perceived usefulness in driving continued use becomes less pronounced because alternative resources support the behavior (Venkatesh & Davis, 2000). The insignificant effects of digital literacy and social influence may reflect changing dynamics in a more advanced digital environment where many users already have basic digital skills and are less influenced by social pressure when deciding whether to continue using well- established technologies. This interpretation aligns with UTAUT, which explicitly considers experience and voluntariness as moderators that can modify the strength of social influence over time and in different contexts (Venkatesh & Davis, 2000). Taken together, the results suggest that continuance intention is multidimensional and contingent. It is shaped by the interaction of personal factors (e.g., financial literacy), system conditions (e.g., infrastructure quality), and psychological evaluations (e.g., satisfaction and trust). These findings support the development of a more contextual and contingency-oriented continuance framework, which is consistent with recent systematic evidence indicating that the determinants of mobile app continuance vary across settings and user groups (Veronika et al., 2025).

CONCLUSION

This study employed the Technology Acceptance Model (TAM) to examine customers' intentions to adopt digital banking services in Timor-Leste, incorporating factors such as financial and digital literacy, trust, perceived security, social influence, and user satisfaction, with infrastructure quality as a contextual moderator. The findings from SmartPLS indicated that perceived ease of use (PEOU) and perceived usefulness (PU) were strong drivers of behavioral intention, suggesting that users are more likely to adopt digital banking when it is easy to use and clearly beneficial. Financial literacy also positively influenced adoption, as users with greater financial knowledge were more confident in evaluating and using digital banking services.

However, digital literacy and social influence did not show significant effects across varying infrastructure conditions, with social influence being non-significant ($p=0.740$) and digital literacy showing no significant effect ($p=0.204$). The study revealed that infrastructure quality plays a crucial moderating role; under low-infrastructure conditions, certain relationships—such as those between user satisfaction and PEOU—became highly significant, indicating a form of cognitive compensation. In contrast, strong infrastructure conditions reduced the influence of digital competence, highlighting a "digital literacy paradox."

Overall, the study concludes that perceptions, capabilities, user experiences, and infrastructure conditions collectively influence the adoption of digital banking in Timor-Leste, thereby contributing to both theoretical understanding and practical advancements in promoting digital financial inclusion.

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