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Determinants of the decision to use digital banking services of individual customers at Vietnamese commercial banks

Thi Thuy Huong Nguyen[1], Van Lanh Nguyen[2*], Minh Nhat Nguyen[3], Thi Minh Ngoc Le[4], Quoc Cuong Truong[5]
[1]Faculty of Foreign Languages, Academy of Finance Hanoi, Vietnam (10000-14000); nguyenthuyhuong@hvtc.edu.vn (T.T.H.N.)
[2]University of Technology and Management Hanoi, Vietnam (10000-14000); dungnguyenthanhtra79@gmail.com (V.L.N.).
[3,4,5]Banking Academy of Vietnam Hanoi, Vietnam (10000-14000); minhnn@hvnh.edu.vn (M.N.N.) ngocltm@hvnh.edu.vn (T.M.N.L.) cuongtq@hvnh.edu.vn (Q.C.T.)

Abstract: This paper investigates the key determinants influencing individual customers' decisions to adopt digital banking services at Vietnamese commercial banks, focusing on factors such as perceived confidence, usefulness, financial cost, risk, trust, and bank brand image. Accordingly, the research employs a quantitative approach, utilizing multivariate regression and scale reliability testing via SPSS 26. Data were collected from 179 valid responses out of 250 online questionnaires distributed over four months (December 2024 to March 2025), targeting Vietnamese banking customers. The results indicate that perceived usefulness and confidence are the most significant drivers of digital banking adoption, while perceived financial cost and risk negatively impact the decision. In addition, trust and bank brand image also positively influence adoption, though to a lesser extent. The model explains 58.3% of the variance in adoption behavior. Moreover, perceived confidence and usefulness emerge as critical factors, underscoring the need for user-friendly and beneficial digital platforms, while cost and risk perceptions remain barriers despite recent fee reductions by banks. For practical implications, Vietnamese banks should enhance service usefulness, bolster customer confidence through education, and strengthen trust via robust security and branding strategies to accelerate digital banking adoption and support a cashless society transition.

Keywords: *Banks, Digital banking services, SPSS Vietnam.*

1. Introduction

The COVID-19 pandemic acted as a critical catalyst for digital adoption. With social distancing measures and lockdowns fundamentally altering consumer behavior, both banks and customers were compelled to transition from physical to digital banking channels. This forced adaptation not only ensured continuous access to essential financial services during the crisis but also permanently redefined customer expectations [1]. According to the latest data from We Are Social's 2024 Vietnam Smart Market Overview, the country's population is now estimated at approximately 100 million, with mobile subscriptions exceeding 160 million, over 75 million Internet users (around 75% penetration), and nearly 80 million social media accounts (80% penetration). These figures underscore the immense potential for digital banking in Vietnam and emphasize the urgent need for banks to innovate and adapt in a rapidly digitalizing market.

Despite these promising developments, several challenges impede the full-scale adoption of digital banking. Barriers such as limited digital literacy, economic constraints affecting access to modern mobile devices, and persistent concerns over cybersecurity and privacy continue to affect consumer uptake [2]. Moreover, longstanding preferences for traditional, cash-based transactions further

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* Correspondence: dungnguyenthanhtra79@gmail.com

complicate the transition to digital services. Consequently, identifying the determinants that influence individual customers' decisions to adopt digital banking is critical for both academic research and practical strategy formulation.

The benefits of digital banking extend well beyond mere transactional convenience. For customers, digital platforms provide the flexibility to conduct transactions anytime and anywhere, enhanced security features, and a more personalized banking experience. For financial institutions, digitalization facilitates the expansion of service networks, reduction in operational costs, and improved customer retention strategies [3]. In today's competitive banking environment, the post-pandemic economic landscape has compelled banks to continually refine their digital strategies to attract and retain a tech-savvy clientele. Recent studies have demonstrated that factors such as perceived usefulness, ease of use, trust in digital platforms, and the effectiveness of promotional incentives play pivotal roles in shaping consumer adoption of digital banking services [4, 5].

International research on electronic banking (E-Banking) consistently highlights the importance of convenience, perceived security, system reliability, and user attitudes as key determinants of digital banking adoption [6]. However, the unique socio-economic and cultural context of Vietnam necessitates a localized examination of these factors. Although domestic research on E-Banking has expanded in recent years, significant gaps remain in studies that specifically address the determinants influencing digital banking adoption among individual customers in Vietnamese commercial banks [7]. Given the rapid pace of technological and societal change, an updated investigation that incorporates recent data and theoretical advancements is both timely and essential.

In response to this research gap, the present study aims to develop an integrative model that elucidates the determinants of digital banking adoption among individual customers at Vietnamese commercial banks. This model synthesizes insights from both intrinsic factors—such as perceived ease of use, security, and trust—and extrinsic factors, including promotional policies, media influence, and broader socio-economic dynamics. By empirically testing this model with up-to-date data, the study seeks to provide actionable insights that can inform policy-making and strategic decisions, ultimately facilitating a smoother transition towards a cashless society.

As the banking sector navigates the dual challenges and opportunities presented by digital transformation, continuous assessment and adaptation of digital strategies are imperative. The findings from this study are expected to contribute significantly to the academic discourse on digital banking while offering practical recommendations for bank managers and policymakers. By addressing both the theoretical and practical dimensions of digital banking adoption, this research aims to enhance our understanding of consumer behavior in the digital era and support the development of more effective, secure, and customer-centric digital banking services.

In conclusion, investigating the determinants of digital banking adoption among individual customers at Vietnamese commercial banks is both timely and significant. In a rapidly evolving digital landscape characterized by technological innovation and shifting consumer behaviors, this research provides a critical framework for understanding the multifaceted factors influencing digital banking adoption. The insights garnered from this study will not only enrich the existing body of literature but also serve as a strategic guide for the continued digital transformation of Vietnam's banking sector as it adapts to the demands of the modern economy.

2. Literature Review

In the rapidly evolving digital age, the banking sector worldwide has been compelled to shift from traditional, branch-based services to digital platforms. This transformation is driven by global trends in technological innovation, increasing Internet penetration, and changes in customer behavior—especially following disruptions such as the COVID-19 pandemic. In Vietnam, these shifts are pronounced, and both domestic and international research has demonstrated that digital banking adoption is influenced by multiple technological, psychological, and socio-economic factors [6-8]. To develop a comprehensive model that explains digital banking adoption in the Vietnamese context, this literature

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review synthesizes prior research and clarifies the rationale behind the selection of each key variable. In the subsequent sections, each construct is discussed in detail before its corresponding hypothesis is introduced. The primary theoretical models used to explain technology adoption—namely, the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), and UTAUT2—have consistently highlighted factors such as perceived usefulness, ease of use, and trust as critical determinants of technology acceptance [6, 8]. In digital banking, however, additional constructs such as perceived confidence, perceived financial cost, and bank brand and image are crucial given Vietnam's unique socio-economic and cultural context [1]. The following sections review each construct in detail and lead to the formulation of our research hypotheses.

2.1. Perceived Confidence

Perceived confidence refers to an individual's self-assurance in effectively using digital technologies. It encompasses the belief that one possesses the requisite digital literacy and skills to navigate online platforms with minimal external support. Earlier studies have shown that higher levels of perceived confidence can reduce technology-related anxiety and foster a positive evaluation of digital services [9]. More recently, Pham and Le [7] have underscored that when customers feel confident using smart devices and navigating digital interfaces, they are more inclined to adopt online banking services. In Vietnam, research indicates that enhancing customers' digital literacy is a key enabler in mitigating uncertainties associated with digital transactions.

H_1: Perceived Confidence positively influences the decision to use digital banking services among customers at Vietnamese commercial banks.

2.2. Perceived Usefulness

Perceived usefulness is defined as the degree to which an individual believes that using a particular technology will enhance their performance or provide tangible benefits [8]. In digital banking, this construct reflects the extent to which customers perceive that online banking delivers advantages—such as convenience, time savings, and accessibility—compared to traditional methods. International studies consistently report that perceived usefulness is a strong predictor of technology adoption [10]. In Vietnam, where the availability of smartphones and high-speed Internet has surged, customers increasingly recognize the practical benefits of digital banking services [11]. This positive perception of utility is crucial for encouraging a shift from conventional banking channels.

H_2: Perceived Usefulness positively influences the decision to use digital banking services among customers at Vietnamese commercial banks.

2.3. Perceived Financial Cost

Perceived financial cost refers to the extent to which customers believe that using digital banking services will incur additional expenses, such as transaction fees, service charges, and potential hidden costs. Although digital banking is often promoted as a cost-effective alternative, customers may be deterred if they perceive that the financial burden outweighs the benefits [12]. Recent studies have highlighted that clarity in fee structures and affordability are critical in shaping adoption behavior. In the Vietnamese context, research shows that high perceived financial costs can significantly reduce the likelihood of adopting digital banking services [7]. As financial considerations directly impact perceived value, they remain a significant barrier in the decision-making process.

H_3: Perceived Financial Cost negatively influences the decision to use digital banking services among customers at Vietnamese commercial banks.

2.4. Perceived Risk

Perceived risk encompasses the consumer's concerns regarding potential negative outcomes from using digital banking services, such as data breaches, fraud, and technical failures. Studies consistently

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show that high levels of perceived risk can deter the adoption of new technologies. In digital banking, these risks are particularly salient due to the remote nature of transactions, which lacks the personal reassurance of face-to-face interactions. In Vietnam, where customers have traditionally relied on cash transactions, concerns regarding online security and privacy are more pronounced [11]. As such, reducing perceived risk is critical for enhancing customer confidence and promoting digital adoption.

H_4: Perceived Risk negatively influences the decision to use digital banking services among customers at Vietnamese commercial banks.

2.5. Bank Brand and Image

Bank brand and image refer to the overall perception of a financial institution's reputation, credibility, and technological competence. A strong brand image can serve as a signal of quality and reliability, reducing consumer uncertainties and enhancing trust in digital services. International studies have demonstrated that customers are more likely to adopt digital banking when they associate the bank with modernity and superior service quality [10, 13]. In the competitive Vietnamese banking market, banks that invest in a robust digital infrastructure and effective brand communication are better positioned to attract customers to their digital channels [7].

H_5: Bank Brand and Image positively influences the decision to use digital banking services among customers at Vietnamese commercial banks.

2.6. Perceived Trust

Perceived trust is the foundational element in online transactions, particularly within the realm of digital banking. It reflects a customer's confidence in the security, reliability, and transparency of a banking platform. Trust is built through robust security measures, effective fraud prevention, and compliance with regulatory standards [7]. When customers trust the digital banking system, they are more likely to overlook minor inconveniences or risks, thereby increasing adoption rates. In Vietnam, persistent concerns regarding data breaches and cyber fraud make the cultivation of trust essential for widespread digital banking adoption [11, 12].

H_6: Perceived Trust positively influences the decision to use digital banking services among customers at Vietnamese commercial banks.

The factors identified—Perceived Confidence, Perceived Usefulness, Perceived Financial Cost, Perceived Risk, Bank Brand and Image, and Perceived Trust—capture both the intrinsic attributes of the digital banking experience and the extrinsic influences unique to the Vietnamese market. Domestic studies consistently underscore the importance of ease of use, usefulness, and trust, while also acknowledging that cost and risk perceptions remain significant barriers [14, 15]. International research further enriches this framework by introducing additional dimensions such as computer effectiveness and subjective norms [10]. Together, these findings substantiate a comprehensive, multi-dimensional model that explains the adoption of digital banking services in Vietnam. The proposed research model integrates these constructs into a cohesive framework, where each determinant is hypothesized to play a distinct role in shaping customer adoption behavior. The model builds on established theories like TAM and UTAUT while incorporating context-specific variables that address the unique challenges and opportunities in the Vietnamese banking sector (Figure 1).

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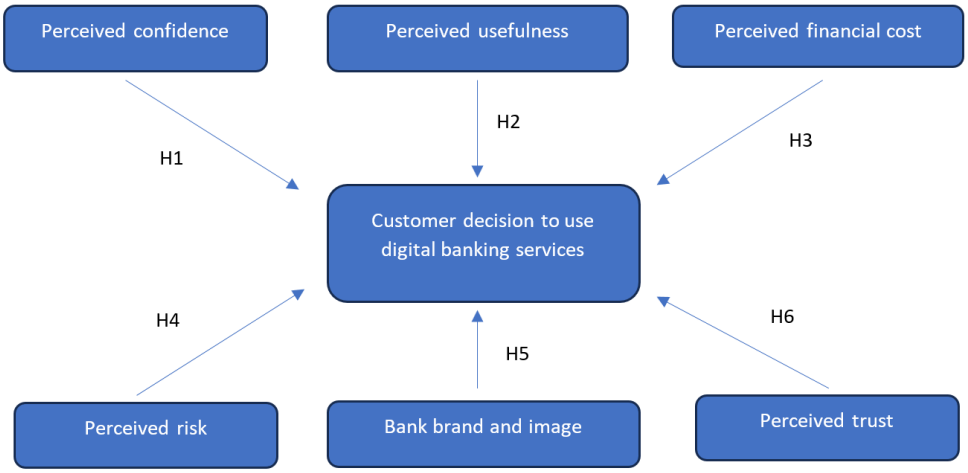

Figure 1.
Proposed Research Model.

3. Results and Discussion

3.1 Descriptive Statistics of the Research Sample

The survey for this study was conducted over a four-month period from December 2024 to March 2025. A total of 250 responses were initially collected via an online questionnaire, which was disseminated through multiple digital channels to ensure wide outreach. After rigorous data screening for completeness and consistency, 179 valid responses were retained for analysis. The questionnaire was designed with two major sections: the first collected detailed demographic information (e.g., gender, age, education, income) and the second focused on items related to the key constructs of digital banking adoption (e.g., perceived confidence, perceived usefulness, perceived risk, perceived financial cost, bank brand and image, and perceived trust). This section provides a detailed description and analysis of the demographic profile of the respondents, which lays a strong empirical foundation for subsequent hypothesis testing regarding the determinants of digital banking adoption among individual customers at Vietnamese commercial banks.

The analysis of gender distribution in the final sample shows that 58.66% of the respondents are male, while 41.34% are female. This slight predominance of male respondents is consistent with earlier findings in the field of digital financial services, where men have often demonstrated a higher propensity to adopt innovative technologies. However, the relatively balanced composition also allows for meaningful analysis of gender-specific differences, particularly in the context of how male and female customers may differ in their perceptions of risk and trust when using digital banking platforms.

Age is a critical variable in understanding technology adoption behavior. In this study, the age distribution of the valid responses is as follows: 61.45% of respondents are between 25 and 35 years old, 27.93% fall in the 35–50 age bracket, and only 10.62% are aged 50 years or above. The overwhelming representation of younger adults (25–35) suggests that digital banking services are primarily embraced by a tech-savvy, digitally native demographic. Younger individuals tend to be more comfortable with and more adept at using digital technologies, making them early adopters of online banking solutions. This age distribution not only reinforces the relevance of digital banking in today's market but also highlights the need for targeted strategies that consider the differing needs and technological proficiencies across age groups.

Educational attainment is another significant factor that influences the adoption of digital technologies. In our sample, 72.07% of respondents hold a university degree, 11.17% have obtained postgraduate qualifications, and 16.76% have a high school level education. The high proportion of respondents with university-level education indicates a customer base that is more likely to appreciate

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the benefits and complexities of digital banking services. A higher level of education is often correlated with a greater understanding of technology and a stronger propensity to adopt new digital tools, which supports the notion that digital banking is particularly attractive to well-educated consumers. This educational profile provides a robust foundation for examining how constructs such as perceived usefulness and trust affect digital banking adoption.

Income level is an important determinant in understanding consumer behavior towards digital banking. For this study, respondents were categorized into four income groups: Below 20 million VND: 30.17%; 20–40 million VND: 32.96%; 40–60 million VND: 28.49%; Above 60 million VND: 8.38%

This distribution shows that the majority of respondents fall into the lower to middle-income brackets, with a relatively small proportion in the highest income group. The near-even distribution among the first three categories suggests that digital banking services appeal across a broad economic spectrum, although there may be differences in sensitivity to service fees and perceived financial costs. For instance, individuals in the lower income bracket might be more cautious about any additional financial burden, while those with higher incomes could be more willing to pay for enhanced convenience and premium service features. Understanding this income segmentation is crucial for banks, as it can inform the development of tiered service models and targeted marketing strategies aimed at minimizing cost-related barriers to adoption.

The descriptive statistics of the sample offer several insights into the profile of digital banking users in Vietnam. The predominance of younger, well-educated individuals, coupled with a balanced distribution of income levels, suggests a dynamic and receptive target market. The slight male predominance observed in the sample is consistent with prior research and provides an opportunity to investigate potential gender differences in digital banking behaviors, such as variations in risk perception and trust.

Furthermore, the age distribution—with a significant majority of respondents in the 25–35 age range—underscores the importance of tailoring digital banking services to meet the expectations of a tech-savvy demographic that prioritizes convenience, speed, and accessibility. The educational profile of the sample further reinforces the potential for rapid adoption of digital banking, as higher education is typically associated with greater familiarity and comfort with digital technologies. The income data reveal that while a substantial proportion of the sample comes from lower to middle-income groups, cost considerations remain a critical factor. Banks must therefore balance the implementation of advanced digital solutions with the need to maintain affordability and transparency in fee structures. The sensitivity to perceived financial cost among these consumers may influence their overall adoption decision, making it an essential variable in our study. Overall, the robust demographic profile obtained from the 179 valid responses provides a comprehensive view of the current landscape of digital banking users in Vietnam. It lays the groundwork for examining the relationships between key determinants—such as perceived confidence, perceived usefulness, perceived financial cost, perceived risk, bank brand and image, and perceived trust—and the decision to adopt digital banking services. The diversity of the sample in terms of gender, age, education, and income ensures that the subsequent analyses will capture a wide range of perspectives and behaviors, thereby enhancing the generalizability of the study's findings.

3.2. Descriptive Statistics of Observed Variables

The analysis based on the descriptive statistics presented in Table 1 provides an in-depth examination of the observed variables in this study, including mean values, standard deviations, and the degree of variability across different variable groups. The data reveals noteworthy trends in user perceptions of various factors, which may pertain to the finance or banking sector. The variables are categorized into seven primary groups, each representing an aspect of user perception or intention.

When examining the mean values of these variable groups, several distinct trends emerge. The Perceived Usefulness (PU) group has the highest mean at 4.474, with a relatively low standard deviation of 0.740. This indicates that the study participants generally perceive the subject of the study

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to be highly useful, with a strong consensus among respondents. The high score for perceived usefulness highlights its positive reception by participants, making it the highest-rated variable group in the study. Following closely is the Bank Brand Image (EBI) group, with a mean value of 4.417 and a standard deviation of 0.747. This high score reflects a positive perception of the bank's brand image, with a relatively consistent level of agreement among respondents, as indicated by the mid-range standard deviation compared to other groups.

The Intention to Use (YIU) group scored a mean of 4.397 with a standard deviation of 0.740. This suggests that participants have a strong intention to use the product or service being evaluated, nearly matching the perceived brand image scores. The low standard deviation also points to a high level of agreement among respondents regarding their intention to use the subject of the study.

The remaining variable groups have slightly lower mean values, including Perceived Trust (PI) at 4.268, Perceived Risk (PR) at 4.240, Perceived Confidence (PC) at 4.188, and Perceived Financial Cost (PFC) at 4.164. Although these mean values are lower than the previously mentioned groups, they are still above the midpoint of the 5-point scale, indicating generally positive responses from participants. Notably, the Perceived Financial Cost (PFC) group has the lowest mean (4.164) and the highest standard deviation (0.884) among all the groups. This suggests a wider range of opinions regarding the financial cost associated with the subject of the study, potentially making it the most contentious aspect evaluated.

The coefficient of variation (CV), calculated as the standard deviation divided by the mean, provides insights into the relative variability of the data. Variables with a higher CV indicate greater fluctuations in responses, whereas lower CV values reflect a stronger consensus among participants.

The analysis shows that PC1 has the highest coefficient of variation at 0.236, followed by PFC1 at 0.225, PR4 at 0.222, PI2 at 0.221, and PC2 at 0.219. These variables fall under the Perceived Confidence, Perceived Financial Cost, Perceived Risk, and Perceived Trust groups. The high coefficient of variation for these variables suggests notable differences in participants' perceptions of these specific aspects. In particular, the high CV values for PC1 and PC2 (both belonging to the Perceived Confidence group) indicate a lack of consensus in participants' confidence in the subject of the study. Similarly, the high CV for PFC1 highlights differences in participants' assessments of the financial cost.

On the other hand, PR2 has the lowest coefficient of variation at 0.132, followed by PU4 at 0.159, EBI2 at 0.162, PU2 at 0.163, and PU5 at 0.164. These variables primarily belong to the Perceived Usefulness group, with one variable from Perceived Risk and one from Bank Brand Image. Notably, three of the five variables with the lowest CVs are part of the Perceived Usefulness group, indicating a high level of agreement among participants regarding the usefulness of the subject being studied. This aligns with the earlier observation that the PU group has the highest mean score and relatively low standard deviation.

When analyzing individual variables, certain ones stand out with higher scores within their respective groups. PU4 has the highest mean value at 4.53, with a standard deviation of 0.72, indicating that this specific aspect of usefulness is highly rated and there is substantial consensus among participants. PU5 and EBI2 also score highly, with mean values of 4.51 and 4.45, respectively, and relatively low standard deviations of 0.74 and 0.72. This further reinforces the observation that participants value the perceived usefulness and brand image of the subject of the study. In contrast, PC1 has the lowest mean value at 3.90, with a high standard deviation of 0.92, indicating that this aspect of confidence is rated lower and there is significant variation in participant opinions. PR4 also has a relatively low mean value of 4.06 with a standard deviation of 0.90.

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Table 1.
Descriptive Statistics of Observed Variables.

Variable Symbol	Mean Value	Standard Deviation
Perceived Confidence (PC)	4.15	
PC1	3.96	0.92
PC2	4.11	0.90
PC3	4.26	0.78
PC4	4.27	0.86
PC5	4.40	0.78
Perceived Usefulness (PU)	4.46	
PU1	4.46	0.75
PU2	4.44	0.73
PU3	4.42	0.84
PU4	4.55	0.72
PU5	4.51	0.74
Perceived Risk (PR)	4.25	
PR1	4.30	0.84
PR2	4.25	0.86
PR3	4.45	0.75
PR4	4.04	0.80
PR5	4.18	0.90
Perceived Financial Cost (PFC)	4.16	
PFC1	4.25	0.86
PFC2	4.23	0.83
PFC3	4.08	0.81
PFC4	4.16	0.84
PFC5	4.12	0.87
Bank Brand Image (BBI)	4.40	
BBI1	4.32	0.77
BBI2	4.39	0.79
BBI3	4.45	0.72
BBI4	4.41	0.73
Perceived Trust (PT)	4.29	
PT1	4.33	0.82
PT2	4.11	0.91
PT3	4.26	0.72
PT4	4.29	0.75
PT5	4.32	0.76
Intention to Use (YD)	4.43	
YD1	4.44	0.73
YD2	4.35	0.74
YD3	4.5	0.71
YD4	4.42	0.75

The data presented in Table 2 highlights the internal consistency of various scales, with most achieving reliability scores ranging from fair to good (Alpha > 0.7). However, the "Perceived Financial

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Cost" (PFC) scale displayed relatively low reliability (Alpha = 0.631), prompting a suggestion to remove the PFC2 item to enhance the scale's overall consistency.

The results indicate that most scales demonstrated good reliability. The Perceived Confidence (PC) scale had the highest Cronbach's Alpha at 0.883, followed by Perceived Usefulness (PU) at 0.855, Perceived Trust (PT) at 0.851, Bank Brand and Image (BBI) at 0.84, and Perceived Risk (PR) at 0.766. In contrast, the Perceived Financial Cost (PFC) scale had the lowest reliability, with an Alpha of only 0.631. Typically, a Cronbach's Alpha of 0.7 or higher is considered acceptable, meaning that most scales meet the required reliability standard, except for PFC.

The first table reveals that all observed variables in the Perceived Trust (PT) scale (ranging from PT1 to PT5) were accepted, with mean values between 16.913 and 17.126. Similarly, the observed variables of the Bank Brand and Image (BBI) scale (from BBI1 to BBI4) were also accepted, showing mean values from 13.076 to 13.207. This is a positive indication that the observed variables in these two scales have good internal consistency.

The Perceived Confidence (PC) scale includes five observed variables (PC1 to PC5) with an overall Alpha of 0.883, reflecting excellent reliability. All observed variables had item-total correlations exceeding 0.6, ranging from 0.653 to 0.851. This demonstrates a strong connection between the observed variables and the overall scale. Notably, PC2 had the highest item-total correlation at 0.851, indicating its significant contribution to the PC scale.

Removing any variable from this scale would result in a decrease in Cronbach's Alpha (ranging from 0.877 to 0.925), confirming that all observed variables positively contribute to the scale's reliability. Therefore, the conclusion is to retain all variables in the PC scale without removing any items.

The Perceived Usefulness (PU) scale achieved an Alpha of 0.855, surpassing the acceptable threshold of 0.7. The observed variables (PU1 to PU5) had item-total correlations ranging from 0.650 to 0.792, with PU2 and PU3 having the highest correlations (above 0.79). This demonstrates that the observed variables effectively measure the concept of Perceived Usefulness.

The Alpha values, if any variable were removed, ranged from 0.802 to 0.900. None of the observed variables had a significant impact on improving the overall Alpha, indicating that all variables in the PU scale should be retained.

The Perceived Financial Cost (PFC) scale had the lowest Alpha of all the scales, at 0.631, which falls below the commonly accepted threshold of 0.7. A closer examination of the observed variables revealed that PFC2 had a very low item-total correlation of only 0.168, significantly lower than the other variables in the same scale, which ranged from 0.313 to 0.505.

Eliminating PFC2 would raise the scale's Alpha substantially, from 0.631 to 0.827, which would surpass the acceptable threshold and improve the scale's overall reliability. Therefore, the recommendation is to remove PFC2, which would significantly enhance the reliability of the PFC scale.

The Perceived Risk (PR) scale had an Alpha of 0.766, indicating acceptable reliability. This scale includes three observed variables (PR1 to PR3), with item-total correlations of 0.644, 0.762, and 0.586, respectively. PR2 had the highest item-total correlation, highlighting its significant contribution to the scale.

Removing any of the variables would not increase the overall Alpha significantly, so all variables in the PR scale should be retained in the research model.

The Bank Brand and Image (BBI) scale demonstrated good reliability with a Cronbach's Alpha of 0.84. The scale consists of four observed variables (BBI1 to BBI4) with item-total correlations ranging from 0.695 to 0.746, with BBI4 showing the highest correlation. This suggests that all observed variables in this scale are well-connected to the overall concept.

The Alpha values, if any variable were removed, ranged from 0.845 to 0.855. Since no variable removal would meaningfully improve the scale's reliability, all variables in the BBI scale should be maintained in the model.

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The final section of the second table shows the Perceived Trust (PT) scale with an Alpha of 0.851, meeting the standard for good reliability. The PT scale includes five observed variables (PT1 to PT5), with mean values between 16.923 and 17.126.

The observed variables had item-total correlations ranging from 0.608 to 0.761, indicating good internal consistency. Removing any of the variables would not significantly increase the overall Alpha, so all variables in the PT scale should remain in the research model.

The item-total correlation is a crucial indicator for assessing the contribution of each observed variable to the overall scale. Typically, this correlation should exceed 0.3 for an observed variable to be considered a meaningful contributor to the scale. In the analyzed scales, most observed variables had item-total correlations exceeding 0.5, demonstrating a strong contribution to the overall reliability. The only exception was PFC2, with an item-total correlation of only 0.168, far below the acceptable threshold. This explains why PFC2 was recommended for removal. Several variables had particularly high item-total correlations, such as PC2 (0.851), PU2 (0.791), PU3 (0.791), PR2 (0.762), and PT3 (0.761). These variables made significant contributions to their respective scales, ensuring strong internal consistency.

Based on the analysis, several conclusions and recommendations can be drawn for the research: Most scales demonstrated good reliability, with Cronbach's Alpha exceeding 0.7, ensuring internal consistency. The Perceived Confidence (PC) scale had the highest reliability with an Alpha of 0.883, while the Perceived Financial Cost (PFC) scale had the lowest reliability at 0.631. To improve the PFC scale's reliability, the removal of the PFC2 variable is suggested, which would raise the Alpha to an acceptable level. All other scales—Perceived Usefulness (PU), Perceived Trust (PT), Perceived Risk (PR), and Bank Brand and Image (BBI)—met the reliability requirements, and no further modifications are necessary. The removal of PFC2 is the only adjustment needed to ensure that all scales in the study achieve acceptable levels of internal consistency and reliability, enhancing the overall robustness of the research findings.

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Table 2.
Cronbach's Alpha test.

Variables	Mean scale if variable is removed	Scale variance if variable is removed	Total variable correlation	Cronbach's Alpha total correlation if variable is removed	Conclusion
Perceived Confidence (PC): Alpha = 0.883					
PC1	16.964	7.029	0.791	0.885	Accept
PC2	16.913	6.944	0.831	0.875	Accept
PC3	16.781	7.513	0.837	0.877	Accept
PC4	16.771	7.709	0.674	0.913	Accept
PC5	16.64	8.217	0.633	0.921	Accept
Perceived Usefulness (PU): Alpha = 0.855					
PU1	17.855	5.744	0.732	0.876	Accept
PU2	17.875	5.660	0.791	0.862	Accept
PU3	17.895	5.562	0.687	0.890	Accept
PU4	17.763	6.157	0.630	0.900	Accept
PU5	17.804	5.613	0.792	0.861	Accept
Perceived Financial Cost (PFC): Alpha = 0.631					
PFC1	16.538	4.517	0.46	0.795	Accept
PFC2	16.559	5.548	0.168	0.527	Reject
PFC3	16.700	4.511	0.513	0.871	Accept
PFC4	16.619	4.542	0.474	0.890	Accept
PFC5	16.66	4.367	0.505	0.872	Accept
Perceived Risk (PR): Alpha = 0.780					
PR1	8.681	1.927	0.644	0.765	Accept
PR2	8.732	1.689	0.762	0.625	Accept
PR3	8.529	2.244	0.586	0.822	Accept
Perceived Trust (PT): Alpha = 0.851					
PT1	16.913	5.979	0.739	0.857	Accept
PT2	17.126	6.071	0.608	0.897	Accept
PT3	16.984	6.317	0.761	0.854	Accept
PT4	16.943	6.300	0.721	0.862	Accept
PT5	16.923	6.240	0.729	0.86	Accept
Bank Brand and Image (BBI): Alpha = 0.841					
BBI1	13.207	3.434	0.695	0.855	Accept
BBI2	13.136	3.315	0.721	0.843	Accept
BBI3	13.076	3.558	0.715	0.846	Accept
BBI4	13.116	3.446	0.746	0.832	Accept

The dataset exhibits strong suitability for exploratory factor analysis (EFA), as indicated by a KMO value of 0.813, which demonstrates excellent sample adequacy. This suggests that most of the variance in the data can be attributed to common factors, rather than unique variance or errors, supporting the use of factor analysis. The high KMO score reflects strong correlations among variables, making them ideal candidates for structure detection. Additionally, Bartlett's test yielded a chi-square statistic of 1526.121 with a highly significant p-value (< 0.001), confirming that the correlation matrix significantly differs from an identity matrix. This indicates that the dataset possesses sufficient inter-variable relationships, fulfilling a key condition for conducting EFA. The combination of a high KMO value and significant Bartlett's test results underscores the dataset's strong appropriateness for EFA. This technique will enable the identification of underlying structures by summarizing observed variables into fewer factors based on shared variance. To proceed with EFA, methods such as principal axis factoring or maximum likelihood estimation are recommended. Further evaluations, including eigenvalue analysis and scree plot inspection, will help determine the optimal number of factors to extract. Factor rotation techniques, such as varimax or promax, can enhance interpretability. In conclusion, the statistical results confirm that the dataset is well-suited for EFA. The KMO value (0.813) and Bartlett's test ($\chi^2 = 1526.121$, $p < 0.001$) provide strong evidence for conducting EFA to

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uncover latent structures within the data. Next steps should involve extracting meaningful factors and validating their reliability through confirmatory factor analysis or related techniques. (Table 3).

Table 3.
KMO and Barlett test.

KMO		0.813
Bartlett Test	Chi-squared	1526.121
H0 (Variables are not correlated with each other)	Std.Dev	223
	P-value	0

Table 4 presents the results of the EFA rotated matrix, revealing six factors with factor loadings for each observed variable. This analysis helps identify the latent structure of the data, clustering observed variables into meaningful factors.

Factor 1 comprises the variables PC1 (0.893), PC2 (0.868), PC3 (0.845), and PC4 (0.729). All these variables have high factor loadings, with PC1 having the highest loading (0.893), suggesting that it best represents Factor 1. The uniform prefix "PC" implies that these variables measure the same concept, making it logical to group them into a single factor.

Factor 2 includes variables EBI1 (0.720), EBI2 (0.837), EBI3 (0.811), and EBI4 (0.848). These variables also have high loadings, with EBI4 showing the highest (0.848). The common prefix "EBI" indicates that these variables measure a similar construct, justifying their grouping under Factor 2.

Factor 3 aggregates the variables PFC1 (0.687), PFC3 (0.703), PFC4 (0.753), and PFC5 (0.773). Although PFC1's loading (0.687) is slightly lower, it still surpasses the acceptable threshold of 0.6 in factor analysis. The remaining variables have loadings above 0.7, with PFC5 showing the highest (0.773).

Factor 4 contains variables PU3 (0.787), PU4 (0.600), and PU5 (0.824). Notably, PU4 has the lowest loading (0.600), yet it still meets the acceptable threshold. PU5's loading (0.824) suggests it best represents this factor.

Factor 5 comprises PT1 (0.739), PT2 (0.800), and PT3 (0.702). PT2 has the highest loading (0.800), while PT3 shows the lowest (0.702), but remains within an acceptable range. The shared prefix "PT" implies that these variables assess a common underlying construct.

Factor 6 includes PR1 (0.774), PR2 (0.876), and PR3 (0.815). PR2's loading (0.876) is the highest, suggesting it is the best representation of this factor. All variables have high loadings, indicating a reliable factor.

The EFA results display a clear factor structure, with observed variables grouped according to their prefixes. This demonstrates consistency between the theoretical framework and the empirical data. No variables exhibit cross-loadings, meaning each variable loads strongly onto only one factor, increasing the discriminant validity of the factors.

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Table 4.
Rotated matrix in exploratory factor analysis (EFA).

	Component					
	1	2	3	4	5	6
PC1	0.893					
PC2	0.868					
PC3	0.845					
PC4	0.729					
PU3				0.787		
PU4				0.600		
PU5				0.824		
PR1						0.774
PR2						0.876
PR3						0.815
PFC1			0.687			
PFC3			0.703			
PFC4			0.753			
PFC5			0.773			
BBI1		0.720				
BBI2		0.837				
BBI3		0.811				
BBI4		0.848				
PT1					0.739	
PT2					0.800	
PT3					0.702	

3.3. Regression Results

Based on the "theoretical research model," this study employs multiple regression analysis to illustrate the relationship between the dependent variable and the independent variables.

$$YD = \beta 1*PC + \beta 2*PU + \beta 3*PFC + \beta 4*PR + \beta 5*PT + \beta 6*BBI$$

Where: Independent variables (Xi): PC, PU, PFC, PR, PT, BBI; Dependent variable (βi): YD

Table 5 displays the results of the linear regression analysis, with the independent variables being FC, PU, PFC, PR, PT, and EBI. Each variable significantly contributes to the model at varying levels of statistical significance.

The standardized regression coefficients (Beta) indicate the relative importance of each variable in predicting the dependent variable. PU has the highest Beta coefficient (0.468), suggesting it is the most influential variable. PT follows (0.289), then PR (0.242), FC (0.211), PFC (0.141), and finally EBI (0.089). This suggests that PU is the most critical predictor in the model.

All variables are statistically significant, with p-values less than 0.05. Four variables (FC, PU, PR, and PT) have high levels of significance ($p < 0.001$), while PFC has $p = 0.012$, and EBI has $p = 0.023$. The Variance Inflation Factor (VIF) for all variables equals 1.000, indicating no multicollinearity issues in the model. This is crucial, as multicollinearity can undermine the reliability of regression coefficients.

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Table 5.
Regression Model Results.

Unstandardized Coefficient		Standardized Coefficient	t	Sig.	Multicollinearity Statistics	
B	**Standard Error**	**Beta**		**Acceptance Level**	**VIF**	
Constant	0.056		0.000	1.000		
PC	0.056	0.211	5.111	0.000	1.000	1.000
PU	0.056	0.468	8.672	0.000	1.000	1.000
PFC	0.056	0.141	2.49	0.012	1.000	1.000
PR	0.056	0.242	4.299	0.000	1.000	1.000
PT	0.056	0.289	5.298	0.000	1.000	1.000
BBI	0.056	0.089	1.671	0.023	1.000	1.000

Table 6 provides an overview of the regression model. The multiple correlation coefficient (R) is 0.761, indicating a strong relationship between the set of independent variables and the dependent variable. The R-squared value is 0.583, meaning the model explains 58.3% of the variation in the dependent variable. The adjusted R-squared is slightly lower at 0.569, a common occurrence when the number of predictors is taken into account. The Durbin-Watson statistic is 2.132, close to the ideal value of 2, suggesting no autocorrelation in the data. This reinforces the reliability of the regression estimates and the related statistical tests.

Table 6.
Model Summary.

Model Summary					
Model	**R**	**R-Squared**	**Adjusted R-Squared**	**Standard Error of the Estimate**	**Durbin -Watson Value**
1	0.761[a]	0.583	0.569	0.7132821	2.132

Table 7 presents the results of the analysis of variance (ANOVA), testing the overall significance of the regression model. The F-value is 26.071 with a significance level of $p < 0.001$, indicating that the model is statistically significant and performs much better than a model with only a constant (no independent variables). This confirms that at least one of the independent variables has a relationship with the dependent variable. The regression sum of squares (102.112) accounts for 57.4% of the total variation (178), while the residual sum of squares (75.888) represents the remaining 42.6%. This aligns with the reported R-squared value (58.3%), confirming the model's explanatory power.

Table 7.
ANOVA Analysis.

ANOVA						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	102.112	6	13.138	26.071	0.000[b]
	Residual	75.888	172	0.539		
	Total	178	178			

The research findings have several important implications. First, the clear factor structure from the EFA indicates that the observed variables have been meaningfully grouped, reflecting distinct latent constructs. This provides a solid foundation for further analyses, especially regression analysis. In the regression model, PU (likely representing Perceived Usefulness) has the strongest impact, suggesting that users' perceptions of the usefulness of a product, service, or system play a critical role in influencing the dependent variable (potentially intention to use or adoption). All variables are statistically significant, although their influence varies. This suggests that intervention or improvement strategies should prioritize the most impactful factors, particularly PU, PT, and PR. The model explains 58.3% of the variation in the dependent variable, which is a relatively high proportion in social research.

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However, 41.7% of the variation remains unexplained, indicating the potential presence of other factors not included in the current model.

The exploratory factor analysis identified six distinct factors with a clear structure, while the regression model confirmed meaningful relationships between the independent variables and the dependent variable. These results offer insights into the data structure and variable relationships, providing a foundation for evidence-based practical decisions. The reliability of the results is supported by statistical indicators such as high factor loadings, the absence of multicollinearity, and the high statistical significance of both the model and the individual variables. These findings have both theoretical value and practical relevance, suggesting that interventions can focus on the most influential factors to affect the dependent variable.

3.4. Discussion of Research Findings

The decision to adopt digital banking services is shaped by several key factors, including Perceived Confidence, Perceived Usefulness, Perceived Financial Cost, Perceived Risk, Perceived Trust, and Bank Brand Image. Perceived Confidence (PC) holds a prominent position with a regression coefficient of 0.282, reflecting the ease with which customers feel they can use digital banking services. Survey results show that customers believe they can easily learn how to use digital banking and perform essential transactions. This strong influence of Perceived Confidence on digital banking adoption echoes the findings of Le and Nguyen [3] which similarly highlight the importance of customer confidence in adopting new banking technologies. Confidence fosters a sense of control over the use of digital services, empowering users to embrace the technology with minimal hesitation.

Perceived Usefulness emerges as the most influential factor, with a regression coefficient of 0.478, indicating its substantial role in shaping customers' intention to use digital banking. This reflects broader shifts in consumer behavior, driven by the increasing reliance on digital transactions, the widespread adoption of QR code payments, and the rising popularity of e-commerce platforms like Lazada. Vietnam has witnessed a rapid transition to digital banking, with banks continuously evolving to meet the growing demand for online services. Digital banking offers numerous advantages over traditional methods, including convenience, speed, and security, which have further cemented its appeal among consumers. These findings align with earlier studies by Pikkarainen [16] who explored the adoption of online banking in Finland and Hong Kong, respectively, as well as local studies by Shanmugam, et al. [17]. The consistent conclusion across these studies is that perceived usefulness significantly drives the adoption of digital banking services, with customers increasingly valuing the time-saving and efficiency benefits they offer.

Perceived Financial Cost, with a regression coefficient of 0.239, ranks fourth among the six factors influencing the decision to use digital banking. This finding contrasts with the conclusions of earlier models proposed by Cruz, et al. [18] which suggested that financial cost negatively impacts the adoption of banking services. However, the recent shift in banking policies, particularly during the 2021-2022 period, has likely influenced this perception. Many banks introduced zero-fee transfer policies and waived account maintenance fees in an effort to remain competitive and attract new users during and after the COVID-19 pandemic. For instance, Techcombank implemented a zero-fee transfer policy, and BIDV offered free transactions via its BIDV SmartBanking platform starting in January 2022. Other banks such as VPBank, MB, TPBank, and VietinBank also eliminated fees for digital banking services. These measures have reduced the perceived financial burden of using digital banking services, explaining why financial cost is no longer seen as a major barrier to adoption.

Perceived Risk, with a regression coefficient of 0.139, is the fifth most significant factor affecting customers' decision to use digital banking services. As digital banking relies heavily on internet-based technologies, concerns about data security and cybersecurity risks remain prevalent. However, this study shows that such concerns are not as prominent as they were in previous research. The pervasive use of social media has made consumers more informed about potential risks, and increased exposure to cases of fraud and data breaches has prompted many to take proactive measures to protect their personal

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information. Furthermore, mainstream media regularly reports on cybersecurity incidents, raising public awareness and encouraging users to adopt more cautious behaviors. These factors have mitigated the negative impact of perceived risk on digital banking adoption, which contrasts with earlier studies, such as those by Kazi, et al. [19] which identified perceived risk as a significant deterrent to digital banking adoption.

Perceived Trust, with a regression coefficient of 0.092, plays a role in shaping the intention to use digital banking, although its influence is not as pronounced as other factors. Trust in digital banking services is primarily built on customers' perceptions of the bank's reputation, the quality of services provided, and the security measures in place to protect their information. While Perceived Trust does not exert the same level of influence as Perceived Confidence or Perceived Usefulness, it remains an important factor in customers' decision-making processes. This is consistent with findings from Yu [20] who have all emphasized the importance of trust in the adoption of digital banking services. Trust creates a sense of reliability, assuring customers that their financial information is secure and that their transactions will be processed smoothly and accurately.

Finally, Bank Brand Image, with a regression coefficient of 0.294, is another crucial factor driving customers' intention to use digital banking services. A strong and recognizable brand enhances customer trust and confidence, making it easier for banks with established reputations to attract and retain customers. In addition to traditional marketing efforts, Bank Brand Image is shaped by the quality of customer service and the professionalism of bank employees who interact directly with customers. The manner in which bank staff handle customer inquiries and support their needs can significantly influence perceptions of the bank's overall brand image. This finding is consistent with prior research by Nguyen and Cao [21] who also concluded that a positive brand image plays a significant role in digital banking adoption. A well-regarded brand serves as a symbol of trust and reliability, reinforcing customers' decisions to use digital banking services over competing alternatives.

In conclusion, the decision to adopt digital banking services is a multifaceted process influenced by a combination of perceived confidence, usefulness, financial cost, risk, trust, and bank brand image. These findings provide valuable insights for banks aiming to increase the adoption of digital banking, highlighting the importance of enhancing customer confidence, demonstrating the usefulness of digital services, and building strong brand recognition to foster trust and loyalty. By addressing these key factors, banks can further strengthen their digital offerings and remain competitive in an increasingly digital economy.

4. Conclusion

The research findings indicate that six key factors influence the decision to use digital banking services among individual customers at joint-stock commercial banks in Vietnam. These factors, ranked by their level of importance, are: Perceived Confidence, Bank Brand Image, Perceived Financial Cost, Perceived Usefulness, Perceived Trust, Perceived Risk. These factors have a significant impact on customers' intention and decision to adopt digital banking services. Among them, Perceived Confidence plays the most crucial role, followed by Bank Brand Image, highlighting the importance of customer familiarity with technology and brand reputation in driving digital banking adoption.

Through the quantitative research method, utilizing validated measurement scales and systematic analyses, the results demonstrate a strong relationship between these factors and the decision to use digital banking services. Notably, the use of SPSS 26 software for data analysis has enabled an accurate and reliable assessment of the impact level of each factor, further reinforcing the validity of the study's findings.

Based on the research findings, strategic recommendations have been proposed to enhance the quality of digital banking services, enabling banks to improve their competitiveness and attract more customers. These solutions focus on: Enhancing customer confidence in using digital banking services. Strengthening bank branding and reputation to build trust and recognition. Minimizing perceived risks

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associated with digital banking services. By addressing these key areas, banks can drive the sustainable development of digital banking services in Vietnam.

Conflict of interest:

The authors declare no conflict of interest

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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