Enhancing E-Banking Adoption in Pakistan: The Role of Privacy, Trust, and the Technology Acceptance Model

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Abstract

This study explores how privacy, trust, and Technology Acceptance Model (TAM) factors influence e-banking adoption in Pakistan. A survey of 189 active e-banking users was analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The results indicate that privacy, perceived ease of use, and perceived usefulness significantly impact adoption and behavioral intention. However, security perception had no significant impact on adoption. The findings suggest that financial institutions should prioritize user-friendly interfaces, transparent data policies, and robust cybersecurity measures to foster trust and enhance e-banking adoption.

Keywords: E-banking, security perception, privacy, trust, behavioral intention, Technology Acceptance Model

Introduction

Even though e-banking has transformed all the financial systems globally, the research into its adoption remains limited in developing countries like Pakistan compared to developed nations. In the country, the retail banking sector holds an excellent opportunity for growth where the e-banking sector has recorded the maximum growth with the growing use of JazzCash and EasyPaisa. However, technological advancements like the digital revolution have brought other challenges such as competition among the banks in Pakistan (Hafiza et al., 2022). In this regard, due to the increased use of digital technologies, various banks have been forced to introduce higher levels of security to reduce threats of cyber-attacks to serve their customers. Globally, e-banking was established to be adopted by 80% of individuals in developed countries, 90% in the UAE, 80% in the Nordic countries, and 76% in the UK (Abid et al., 2023; Kwateng et al., 2018). Thus, in 2022, the share of the people of Pakistan using e-banking was 67.5 million, which is 29% of the country's population (S. K. Khan et al., 2022). Despite this progress, concerns over security, privacy, and trust remain significant barriers to adoption. To lessen these issues, it is crucial to utilize technology, employ

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strict rules to govern the industry and make consumers aware of potential risks.

In this context, e-banking can be considered a refined digital solution that helps people and companies maintain and access their accounts and perform transactions with enhanced speed and security (Salem & Yakhou, 2024). Web banking helps to perform extensive online banking operations including bill payments, transfers, account information, financial investments, currency exchange, transaction confirmation, and global web connectivity through the Internet (Akhter et al., 2022). It also improves the efficiency and competitiveness of private and government banks, thus greatly assisting in the formation of the national economy (Almansour & Elkrghli, 2023). In Pakistan, e-banking evolved with the ability to make banking transactions and electronic funds transfers starting from the late 1990s and early 2000s. The State Bank of Pakistan (SBP) has extended significant support towards the digitization of banking services to increase the participation and effectiveness of the participating institutions. The above assessment of the SBP shows that the private sector banks' credit (PKR in billion) has grown by 6.8% in the first six months of Fiscal Year 2022 through other sectors. This growth supports the argument that there is a need for more innovations in digital platforms to help with faster financial transactions and increased customer satisfaction.

This study reveals the factors that impact e-banking adoption by considering privacy, trust, and technology acceptance model (TAM) elements like perceived ease of use (PEU), perceived usefulness (PU), and behavioral intention (BI) altogether. Lastly, by integrating BI as a mediator between PEU and PU to explain e-banking, the present study contributes to the elaboration of theoretical models like TAM in developing nations. This study contributes to the existing literature on e-banking in the following ways: However, similar topics have not received much attention in other countries such as Pakistan although it has its specific technological, cultural, and socio-economic conditions affecting the banking sector. This study aims to fill this gap by answer the question that how the security measures, concerns about privacy, trust, and TAM factors, including PEU, PU, and BI, impacting on e-banking in Pakistan

This study contributes to the public, private, and foreign banking sectors by highlighting security as a key attribute in e-banking adoption. It identifies challenges associated with e-banking services and provides practical solutions for banks to enhance security measures. Additionally, the research increases awareness of e-banking user perceptions regarding security, privacy, trust, and key TAM factors (PEU, PU, and BI) across different types of banks in Pakistan. From a theoretical perspective, this study establishes the relationship between security perceptions, privacy, and trust in the context of e-banking

adoption.

Literature Review

E-banking in Pakistan

E-banking has significantly influenced Pakistan's financial sector, with 67.5 million users in 2022, making banking more accessible, especially in rural areas (Abid et al., 2023). Services like JazzCash and EasyPaisa have become convenient tools for financial management (Akhter et al., 2022). However, its extensive use is threatened by security risks such as cybercrimes, identity theft, and fraud (Hussain et al., 2017). Even though global studies consider trust and security as drivers for the adoption of e-banking, Pakistan's unique cultural, technological, and economic environment remains to be investigated. With mobile internet users forecasted to reach 186.9 million in 2022, there lies a future opportunity for the expansion of e-banking, but challenges such as digital literacy and trust remain to be addressed. State Bank of Pakistan's liberalization for enhanced security and user awareness (Murthy et al., 2009). Compared to past research, the current study focuses on differences in online risk perceptions and offers pragmatic solutions to increasing digital literacy and trust in Pakistan (Albort-Morant et al., 2022). While the State Bank has promoted digital banking, enhanced security, transparency, and user awareness are required to attain higher adoption (Danish & Usman, 2010).

Security Perception, Privacy concern and trust in E-Banking

Security and privacy are the most important to ascertain user confidence in e-bank services. In Pakistan, security perception is a dominant factor, as customers are particularly concerned about risks such as identity theft, transaction failure, and network instability in online financial transactions (Akhter et al., 2022). However, awareness of these threats is low, and most consumers lack confidence in e-banking systems due to limited digital literacy (M. M. Hussain et al., 2023). While earlier literature highlights perceived risks like privacy invasion, fraud, and hacking (Kaulu et al., 2024), there is limited understanding of how these perceptions evolve with trust-building strategies and technology adoption.

Privacy concerns, especially regarding personal information protection, are also crucial to e-banking adoption (Hafiza et al., 2022). Privacy is defined as the user's preference to conduct banking transactions online using various devices. While studies have explored privacy threats such as data confidentiality breaches and unauthorized access (Shafiya et al., 2023a), the socio-economic and technological causes behind these threats remain underexplored. Saeed (2023) noted that stronger privacy measures attract more users, as people tend to use services that safeguard their personal data. This is particularly true in Pakistan, where users with lower technical skills visit only trusted websites, often recommended by others. Since privacy and trust are inversely related, high privacy risks result in low trust

and reduced use of online banking services.

Trust is thus a key construct linking security perception and privacy concerns to behavioral intention. Empirical evidence shows that perceived strong security measures enhance user trust, increasing their willingness to use e-banking (Bouaoulou & Lakssoumi, 2024). Trust also plays a vital role in reducing the uncertainty and risk associated with online transactions (Shafiya et al., 2023a; Martínez-Navalón et al., 2023). Factors such as trust, ease of use, and cost greatly influence e-banking adoption, with customers more inclined to use these services when confident their data is secure (Saeed, 2023; Mwiya et al., 2017). In Pakistan, customer confidence in privacy and system reliability driven by trust strongly affects e-banking adoption (Subramani et al., 2020).

Based on the above literature discussion we develop the following hypotheses:

H_1: A positive perception of security significantly enhances consumers' willingness to adopt e-banking services.

H_2: Privacy has a significant effect on the adoption of e-banking

H_3: Trust significantly enhances the adoption of e-banking services.

Perceived Ease of Use (PEU) and Perceived Usefulness (PU),

The Technology Acceptance Model (TAM) posits that Perceived Ease of Use (PEU), and Perceived Usefulness (PU) significantly influence behavioral intention (Davis, 1989). PEU is the perception of users that e-banking is easy, whereas PU is the perceived usefulness. Empirical evidence establishes that easy-to-use systems are perceived as more useful, and this is consistent with the users' intention to use them (Venkatesh et al., 2003).

As mobile banking and e-payments grow, ease of use becomes essential in promoting digital services (Bouaoulou & Lakssoumi, 2024). PEU also influences behavioral intentions and PU when interfaces are easy to navigate (Hailat et al., 2023).

Yet, many studies fail to examine how PEU relates to other factors, such as security and trust, in Pakistan. Simplifying interfaces alone may not suffice if users still perceive risk or lack trust. Additionally, growing adoption still faces barriers like security concerns and resistance to change.

Perceived Usefulness (PU) also predicts consumers' buying behavior. If e-banking helps users manage finances more effectively, adoption increases (Khan & Abideen, 2023). While PU is recognized, few studies explore how it's shaped by Pakistan's financial literacy, tech access, and socio-cultural dynamics. PU is crucial in both conventional and Islamic banking, where trust, literacy, and perceived security help reduce

barriers like adoption cost and risk (Murad et al., 2021; Abbas & Arif, 2023). Still, these factors are often studied in isolation, with little focus on their combined effect on PU and adoption. For example, while trust and security are known influencers, their role in shaping PU remains underexplored in Pakistan's dual banking system. TAM emphasizes that PU drives adoption when services are also perceived as easy to use (Kaulu et al., 2024b).

Finally, behavioral intention, influenced by ease of use and usefulness, is key to e-banking adoption. It reflects a user's preference to engage with the service (Hossain et al., 2023). In Pakistan, psychological drivers like social influence, performance expectancy, and facilitating conditions are also influential (Abikari et al., 2023). However, TAM-based studies mostly focus on external factors, neglecting individual barriers like lack of trust or resistance to change (Pavlou, 2003; Kim et al., 2009). Understanding these aspects is vital, especially where culture and religion deeply influence behavior (Mwiya et al., 2017).

Based on the above discussion we propose the following hypotheses:

H_4: Perceived ease of use as a significant impact on the behavior intention

H_5: Perceived usefulness as a significant impact on the behavior intention of the consumers.

Mediating role of behavior intentions in the adoption of E-banking

The mediating role of Behavioral Intention (BI) is key in linking PEU and PU to actual adoption. As per TAM, BI represents a psychological commitment that turns perceptions into behavior. It mediates the relationship between PEU and PU, as ease of use boosts perceived benefits, shaping the intention to use the service (Davis et al., 1989; Venkatesh & Davis, 2000). BI also strengthens the link between PU and actual usage, highlighting its critical role in technology adoption (Riffai et al., 2012).

However, BI does not mediate all relationships equally. For security perception and privacy concerns, their effect on trust is more direct, with no mediation by BI (Pavlou, 2003). Users rely on trust itself rather than intention when adopting e-banking. This aligns with prior studies, which argue that trust-based adoption is more influenced by risk perception and assurance mechanisms than by behavioral intention (Gefen et al., 2003; Zhou, 2011).

We develop the following hypotheses to test the mediation role of behaviour intentions:

H_6: Behavioural intention mediates the relationship between perceived ease of use and e-banking adoption.

H_7: Behavioural intention mediates the relationship

between perceived usefulness and e-banking adoption.

The above literature review provides an overview of the key factors influencing e-banking adoption, particularly through the lens of the TAM. It has explored critical constructs such as perceived ease of use, perceived usefulness, trust, privacy concerns, and security perceptions. While much research has focused on the global relevance of security concerns in technology adoption, there is limited exploration of how cultural, socio-economic, and technological factors shape user behavior in Pakistan. This study addresses this gap by examining how different constructs under TAM impact e-banking adoption in Pakistan.

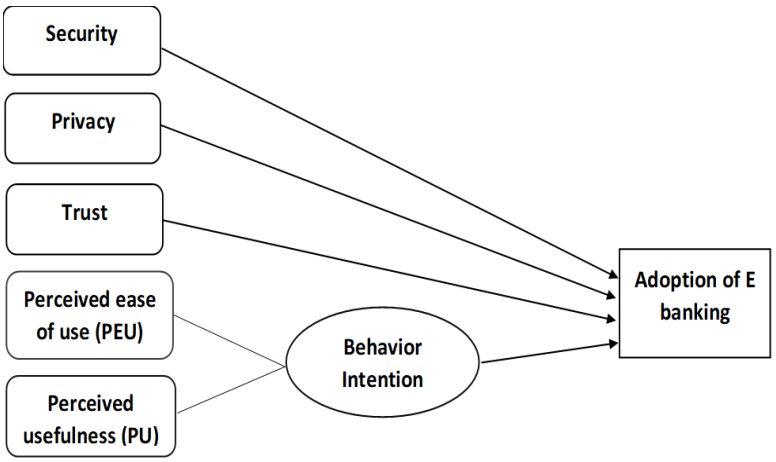

Figure 1. Conceptual Framework

Methodology

Population and Sample Selection Criteria

This study was conducted in Quetta, Pakistan, to examine concerns and attitudes regarding security and e-banking services adoption. The total population for this study consisted of e-banking users in Quetta, Pakistan. The selection criteria were based on individuals who actively use online banking services provided by various financial institutions. The sample was drawn using a structured approach to ensure representativeness within the target demographic.

Sampling and Data Collection

An online survey questionnaire was administered to active e-banking users, including those utilizing JazzCash, EasyPaisa, and e-wallet accounts. The participants were selected using a convenience sampling

technique, ensuring a diverse representation of e-banking users from different areas of Pakistan. The total population of e-banking users in Pakistan was not specifically determined; however, the study targeted individuals who actively engage with digital banking services.

The sample size was determined using G*Power software. The G*Power calculation provided a minimum required sample size of 145 to achieve adequate statistical power. However, the study opted for 189 respondents to enhance the robustness of statistical analysis, account for potential non-response bias, and ensure more reliable and generalizable findings. The larger sample size helps improve the precision of estimates and strengthens the validity of the results.

Measures

In order to measure the constructs in the proposed framework, this study utilized validated scales in previous studies. Perceived Ease of Use (PEU) and Perceived Usefulness (PU) were taken from the Technology Acceptance Model (TAM) of Davis (1989) and tested thoroughly in digital adoption studies. Security and Privacy scales were taken from Belanger et al. (2002), tested by Lallmahamood (2007), particularly on consumer safety perception in online banking settings. Trust was measured using items taken from McKnight et al. (2002), testing credibility and reliability in technology-mediated transactions. Finally, Behavioral Intention and Adoption of E-Banking were measured using items taken from Venkatesh et al. (2003) and tested in the digital financial services setting. All items were tested using a five-point Likert scale ranging from "strongly disagree" to "strongly agree.".

Data Analysis Technique

For data analysis, Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed due to its suitability for complex relationships among multiple variables (Sarstedt & Cheah, 2019; Zeng et al., 2021). This method was chosen for its ability to work with small sample sizes and its flexibility in handling non-normally distributed data. PLS-SEM enabled the assessment of both direct and indirect effects, as well as the moderating roles of key constructs such as trust, privacy, and perceived usefulness (Hair Jr et al., 2021). Additionally, its applicability to reflective constructs, such as trust and privacy, ensured reliable measurement generation. Behavioral intention was also examined to see how it is correlated with PEU and PU at the time of adoption.

Cronbach Alpha was utilized through PLS- SEM to ascertain reliability where the survey instrument items had a high level of internal consistency in measuring the same construct (Hair Jr et al., 2017). The study was also integrated ethically with regard to how the rights of the participants could be protected and their information well concealed. Ethical procedure was adhered to in this study, and the set laws of data

confidentiality regarding Pakistan were maintained in the handling and processing of the data.

Results

Measurement Model Assessment

To assess the reliability of indicators, the factor loadings for all the items were examined. Most indicators had high loadings above the threshold value of 0.70 (Hair et al., 2019), indicating good item reliability and good representation of the respective constructs. Specifically, factor loadings for Adoption (AD) ranged between 0.856 and 0.891, for Behavioral Intention (BI) ranged between 0.795 and 0.849, for Perceived Privacy (P) ranged between 0.834 and 0.860, for Perceived Ease of Use (PEU) ranged between 0.796 and 0.881, for Perceived Usefulness (PU) ranged between 0.803 and 0.832, and for Trust (T) ranged between 0.783 and 0.866 each of these being statistically significant at $p < 0.001$. For Security (S), although two indicators (S1 = 0.912, S3 = 0.642) met acceptable cutoffs, one item (S2 = 0.177) had significantly low and non-significant loading at $p = 0.481$, indicating a poor correlation with the underlying construct and dropped from final analysis. Still, the general measurement model exhibited high reliability and validity. Because of the brevity, the entire factor loading table is not included here but can be provided on request.

To establish the reliability and validity of the constructs, Cronbach's alpha, composite reliability (rho_c), and Average Variance Extracted (AVE) were measured. Hair et al. (2019) confirms that Cronbach's alpha and composite reliability measures above 0.70 are satisfactory reliability, and AVE measures above 0.50 are satisfactory convergent validity. Cronbach's alpha above 0.7 is satisfactory reliability, as indicated from table 3, which was measured for most constructs: Adoption (AD) = 0.843, Behavioral Intention (BI) = 0.762, Privacy (P) = 0.801, Perceived Ease of Use (PEU) = 0.801, Perceived Usefulness (PU) = 0.759, and Trust (T) = 0.869, all statistically significant ($p = 0.000$). However, Security (S) showed lower reliability with $\alpha = 0.484$ (see Table 1).

Table 1 *Reliability and Validity*

	Cronbach's Alpha	Composite Reliability (CR)	Average variance extracted (AVE)
AD	0.843	0.905	0.761
BI	0.762	0.863	0.677
P	0.801	0.881	0.712
PEU	0.801	0.883	0.715

PU	0.759	0.861	0.675
S	0.474	0.635	0.425
T	0.774	0.869	0.689

Composite Reliability (CR) also supported these findings, with all the constructs being 0.7 and above except Security (CR = 0.635) and Average Variance Extracted (AVE) values establishing convergent validity for all the constructs except Security (0.425), which was below this value. AD (0.761), BI (0.677), P (0.712), PEU (0.715), PU (0.675), and T (0.689) were above the >0.5 value. Despite weaknesses in the Security construct, all findings were statistically significant (p = 0.000), confirming overall reliability and validity (Sarstedt & Cheah, 2019).

The Security (S) construct has been found to have low reliability and validity as discussed below for many reasons. First, the questions in the survey might not have been sufficient to elicit all the issues that the users have with security. For instance, the questions were mainly directed towards aspects such as unauthorized access and did not address other concerns such as data loss or fraud. For the improvement of this, the questions can be modified to include data security, fraud, and the reliability of the system.

Structural Model Assessment

The PLS-SEM path model (Figure 2) includes constructs (e.g., S, P, PEU, BI, AD) and indicators (e.g., S1, P1). Latent variables are measured using indicators, which are observable signs. The links' intensity and direction are indicated by effect size (e.g., from "S" to "AD" with an effectiveness of 0.625). P-values, like 0.000, show relationship significance, with the threshold set at 0.05. The exogenous variable "S" has a significant coefficient of 0.625 for "AD" at $p < 0.000$, while "T" has a coefficient of 0.007 at $p < 0.007$ (Table 2). Regression analysis indicates that predictors account for some changes in the dependent variables, but not all (R^2 values: 0.581 for "BI" and 0.559 for "AD" see Table 3). The bootstrapping process confirmed the reliability and significance of the relationships, although predictions for specific factors like "BI" and "AD" are not very strong.

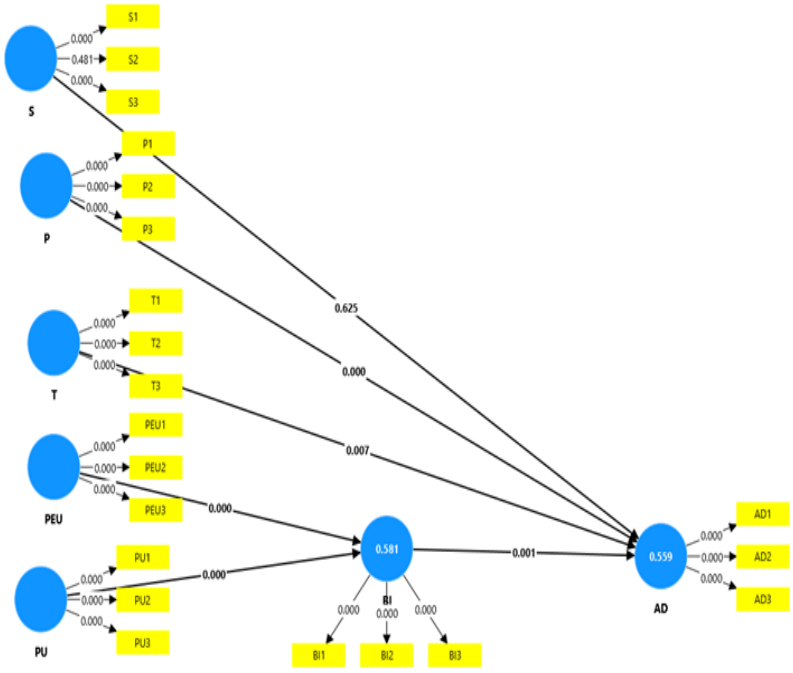

Figure 2 Direct Effect

Table 2
Path coefficient

	(β)	Standard deviation (STDEV)	T statistics	P values
BI → AD	0.239	0.073	3.254	0.001
P → AD	0.391	0.079	4.917	0.000
PEU → BI	0.366	0.092	3.979	0.000
PU → BI	0.449	0.094	4.790	0.000
S → AD	-0.030	0.062	0.488	0.625
T → AD	0.252	0.094	2.693	0.007

Table 3

R square

	-Square	Stan dard deviation	T statistics	P values
AD	.559	0.05 5	10 .170	0 .000
BI	.581	0.05 8	9. 947	0 .000

Model Fit

The Standardized Root Mean Square Residual (SRMR) is an indicator of model fit in structural equation modeling (SEM), with lower values indicating a better fit. According to Hu and Bentler (1999), an SRMR value below 0.08 is generally considered acceptable for model fit.

The saturated model has an SRMR of 0.071, as shown in table 6, and the estimated model shows 0.076, both within the acceptable range. Confidence intervals (95%: 0.065; 99%: 0.070) further confirm the model's fitness, though there is room for improvement.

Table 4

Standardized Root Mean Square Residual (SRMR)

	SRMR	95%	99%
Saturated model	0.071	0.061	0.066
Estimated model	0.076	0.065	0.070

Discussion

This study explores the factors influencing the adoption of e-banking in Pakistan, emphasizing privacy concerns, trust, security perceptions, and the TAM constructs. The findings largely corroborate previous research, confirming that privacy and trust are central to e-banking adoption. According to the research results of Akhter et al. (2022a), there is a greater chance of users using e-banking services if they believe that the platform will secure their personal data. This result is consistent with Saeed (2023), who is of the opinion that users who have strong privacy guarantees are more likely to use e-banking services, particularly in settings where data breaches or identity theft risks are present. The importance of privacy concerns in Pakistan is much more emphasized, as trust in digital financial systems is frequently eroded by poor digital literacy and a lack of awareness of potential risks (Akhter et al., 2022a).

The security perception was found to have a lower influence on e-banking adoption than anticipated, something that can be attributed to the socio-cultural environment in Pakistan. Users are likely to prefer convenience and trust to security threats (Akhter et al.,2022; Bouaoulou & Lakssoumi 2024). Such a trend could reflect a lack of awareness of the entire range of security threats, considering that many Pakistani users are not digitally literate enough (Mwiya et al., 2017). Additionally, the perception that security threats may not have a crucial influence on e-banking adoption, based on lack of awareness (Hailat et al., 2023).

The mediating role of BI between PEU and PU to adopt e- banking is consistent with TAM as conceptualized by Davis (1989) and Venkatesh & Davis (2000). The conclusion of this research aligns with the notion that perceived ease of use and ease of use influences BI, and consequently, adoption is positively determined (Hailat et al., 2023; Venkatesh et al., 2003). When there is a positive perception of ease of use of e-banking services and perception of benefits accruing from its usage, adoption intention increases. This conclusion confirms the findings by prior research advocating perceived ease of use and perceived usefulness are influential drivers to adopt technology, especially mobile bank services (Mwiya et al., 2017; Abbas & Arif, 2023). The direct effect of user experience on adoption intention underscores the essence of developing navigation-friendly interfaces responsive to users' functional requirements.

While security and privacy concerns were topmost to the adoption process, the present study confirmed that trust had a greater influence on users' behavioral intention towards e-banking. This finding is in line with the argument by Shafiya et al. (2023a), that trust has a mediating role between perceived risk and the adoption intention towards new technologies. In Pakistan, where cases of cybercrimes and fraud are common, trust that the e-banking platform can protect users' data is of topmost importance (Subramani et al., 2020). These findings are in line with the argument by Bouaoulou & Lakssoumi (2024), that users' trust in the system is a driving force for adoption in environments with high perceived risks, such as online banking. Without trust, even the most friendly of a platform cannot cause adoption, keeping in mind that users still have reservations regarding the security and reliability of the service.

Conclusion

This research investigated the function of privacy, perceived security, ease of use, and trust in the prediction of e-banking technology adoption in Pakistan through the TAM with structural equation modeling technique (PLS-SEM). The findings confirm that perceived trust, privacy, and PEU positively influence consumer adoption of e-banking services. However, security concerns, while important internationally, were considered less significant in Pakistan. This suggests that Pakistani users prioritize trust and convenience over security, possibly due to low-security

literacy or a preference for simple, user-friendly systems.

Limitation and future research directions

This study has certain limitations. Firstly, it relies on a convenience sample, which may limit the generalizability of findings. Secondly, the study focuses only on Pakistan, necessitating cross-cultural comparisons to understand regional variations in e-banking adoption.

Future studies should explore how cultural, psychological, and demographic factors influence the adoption of e-banking across different regions. A comparative analysis between developing and developed economies could provide deeper insights into how security perceptions vary globally and whether similar trust-based adoption patterns exist elsewhere. Additionally, research could examine the role of financial literacy in shaping security concerns, as users with higher digital and financial awareness may exhibit different attitudes toward security and privacy.

Another promising avenue for research is the longitudinal analysis of e-banking adoption, tracking how users' perceptions of trust, security, and ease of use evolve over time, particularly as cybersecurity threats become more sophisticated. Future research can also incorporate qualitative methods, such as in-depth interviews or focus groups, to explore the motivations and concerns of different user segments beyond survey-based quantitative approaches

Theoretical and practical implications

This study contributes to the Technology Acceptance Model (TAM) by incorporating perceived trust, privacy, and ease of use as key determinants of e-banking adoption in Pakistan. While traditional TAM frameworks emphasize perceived usefulness and ease of use, our findings highlight the greater importance of trust and privacy concerns in shaping user behavior. This suggests that in regions with lower cybersecurity literacy, trust may play a more significant role than formal security measures.

Finally, the practical implication of the study involves focusing on enhancing user trust through transparent security measures, user-friendly interfaces, and educational programs on cybersecurity by financial institutions and banks. Implementing globally recognized security standards can further boost user confidence in e- banking system in Pakistan.

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