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Extended Technology Acceptance Model (TAM) for Evaluating Digital Banking Adoption in Saudi Arabia

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ABSTRACT

This study investigates the factors influencing the acceptance and use of digital banking services in Saudi Arabia, applying the technology acceptance model. Data were collected from 406 respondents using a structured survey to measure perceived usefulness (PU), perceived ease of use (PEOU), Trust, social influence (SI), perceived risk (PR), behavioral intention (BI), and actual usage. The results showed that PU, PEOU, Trust, SI, and BI significantly positively affected digital banking usage, while PR had a significant negative impact. The findings align with existing literature, reinforcing the importance of user-friendly interfaces, robust security measures, and SI in driving digital banking adoption. Practical implications include enhancing digital banking platforms' usability and trustworthiness to boost user engagement. Future research should consider longitudinal studies and explore the impact of emerging technologies on digital banking adoption.

KEYWORDS

digital transformation, adoption behavior, perceived usefulness (PU), perceived ease of use (PEOU)

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1. Introduction

The advent of digital banking has revolutionized the financial industry, offering unprecedented convenience and efficiency to consumers worldwide. Digital banking encompasses a wide range of financial services accessible through electronic channels, such as mobile apps and online platforms, enabling users to perform transactions, manage accounts, and access financial products without the need to visit physical branches (Baabdullah et al., 2019; FinTech Saudi, 2022). In Saudi Arabia, the digital banking landscape is rapidly evolving, driven by technological advancements, changing consumer preferences, and strategic initiatives, such as Vision 2030. This national initiative aims to diversify the economy and foster innovation across various sectors, including banking, positioning Saudi Arabia as a regional leader in digital transformation (SAMA, 2023; Statista.com, 2024). Despite substantial investments and efforts to promote digital banking, adoption rates among Saudi consumers remain inconsistent. While advanced digital banking platforms are widely available, a significant portion of the population still prefer traditional banking methods. This inconsistency suggests that there are underlying factors hindering widespread adoption, which, if not addressed, could limit the potential benefits of digital banking for both consumers and financial institutions. Therefore, understanding these factors is crucial for banks to design strategies that effectively meet consumer needs and align with the goals of Vision 2030. This study is driven by the need to address significant gaps in the current understanding of digital banking adoption, particularly within the Saudi Arabian context. While the technology acceptance model (TAM) has been extensively used to analyze technology adoption worldwide, research focusing on the unique socio-cultural and economic factors in Saudi Arabia, such as trust, social influence (SI), and perceived risk (PR), remains limited. Previous studies have often overlooked how these factors interact to influence user behavior, which is critical in a region where digital transformation is central to the national development strategy (Luo et al., 2010; Mahdi, 2011). Moreover, much of the existing research is centered on developed markets, failing to capture the nuances of emerging economies, such as Saudi Arabia's, where digital banking is still evolving. This study seeks to bridge this gap by providing a detailed examination of how perceived usefulness (PU), perceived ease of use (PEOU), and other critical factors, including trust and SI, affect digital banking adoption. By focusing specifically on the Saudi context, the study aims to uncover insights that can help financial institutions address barriers to adoption, enhance user engagement, and support the broader digital transformation goals outlined in Vision 2030. Additionally, this research contributes to the theoretical development of the TAM by integrating contextual and cultural variables that have been underexplored in prior studies. While PU and PEOU are recognized as key determinants of technology acceptance, the role of cultural dynamics and local context in moderating these relationships requires further investigation. By introducing a more comprehensive model that incorporates these elements, the study aims to expand the traditional understanding of digital banking behaviors, providing both theoretical advancements and practical recommendations for banks and policymakers to improve user experience, build trust, and promote widespread adoption.

The TAM, introduced by Davis (1989), is a widely recognized framework for analyzing technology adoption. It posits that PU—the belief that using a system will enhance one's job performance—and PEOU—the belief that using the system will require minimal effort—are critical determinants of user acceptance. Over the years, various studies have applied the TAM to explore the factors influencing digital banking adoption in both developed and emerging markets, highlighting the importance of additional variables, such as trust, security, and PR, in shaping consumer behavior (Gefen et al., 2003; Luo et al., 2010; Prastiawan et al., 2021).

In the context of Saudi Arabia, cultural and economic factors, along with concerns about trust and security, add layers of complexity to digital banking adoption. Prior research in the region has identified SI, trust in digital platforms, and perceived security risks as significant determinants of user adoption (Baabdullah et al., 2019; Mahdi, 2011; Alshurideh et al., 2019). However, there is still a lack of comprehensive understanding of how these factors interact

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specifically in the Saudi Arabian context, necessitating further exploration through the TAM framework.

To address the identified gaps, this study employed a quantitative research design, utilizing surveys to collect data from users of digital banking services in Saudi Arabia. The research focuses on examining the relationships among PU, PEOU, and other influential factors, such as trust, SI, and PR. The methodology includes detailed descriptions of the research design, data collection methods, sampling techniques, and the analytical approaches employed to analyze the collected data. The objective is to identify the key drivers of and barriers to digital banking adoption, providing insights into user behavior and preferences (Venkatesh et al., 2003; Tarhini et al., 2016).

The study's findings and results revealed the critical factors influencing digital banking adoption in Saudi Arabia, with a particular focus on the relationships among PU, PEOU, and actual usage (AU). The results showed that PU, PEOU, Trust, and SI significantly impacted the behavioral intention (BI) to use digital banking services, while PR presented a barrier to adoption (Mohapatra et al., 2020; Yin and Lin, 2022). The data analysis includes descriptive statistics, correlation analyses, and model assessments to provide a comprehensive understanding of these relationships.

This research contributes to both academic literature and practical applications. Academically, it expands the body of knowledge on digital banking adoption in the Arab region, specifically within the Saudi context, where empirical evidence remains scarce (Laradi et al., 2023; Rithmaya et al., 2024). Practically, the study offers strategic recommendations for banks and policymakers, aiming to enhance user experience, build trust, and accelerate the adoption of digital banking services. The findings are crucial for financial institutions seeking to align with the goals of Vision 2030 by promoting financial inclusion and digital literacy.

This paper is organized as follows. Section II discusses the evolution and current landscape of digital banking in Saudi Arabia. Section III reviews the theoretical framework of the TAM and its application, highlighting the key factors influencing digital banking adoption. Section IV outlines the methodology, including research design, data collection methods, and analytical techniques. The Results section presents the study's findings, with a focus on the relationships between key variables, such as PU and PEOU, and digital banking adoption. The Discussion section interprets the findings in the context of existing literature and provides recommendations for financial institutions and policymakers. The Conclusion summarizes the key findings and contributions, reiterating the importance of promoting digital banking adoption in Saudi Arabia.

Evolution and Current Landscape of Digital Banking in Saudi Arabia

The Banking Sector in Saudi Arabia

The banking sector in Saudi Arabia includes a variety of entities categorized into local banks, digital banks, and foreign banks. As per the latest data (SAMA, 2023), there are 11 local banks (see Table 1), three digital banks (see Table 2), and 23 foreign banks operating in the Kingdom (see Table 1). The FinTech Saudi Annual Report 2021–2022 highlights that the Saudi Council of Ministers approved digital banking licenses for STC Bank, Saudi Digital Bank, and D360 Bank. These newly licensed digital banks are expected to introduce innovative financial solutions tailored to the needs of diverse customer segments, thus enhancing competition and driving further growth in the sector (FinTech Saudi, 2022).

As this study focuses only on local and digital banks, Table 1 summarizes the existing operational local and licensed digital banks in Saudi Arabia. A total of 1,927 branches are numbered as of the end of 2022 (SAMA, 2023).

Table 1: Summary of operational local banks in Saudi Arabia

#	Entity name	Bank type	Activity type
1	Al Rajhi Bank	Local bank	Banking business
2	Riyad Bank	Local bank	Banking business
3	Arab National Bank	Local bank	Banking business
4	Banque Saudi Fransi	Local bank	Banking business
5	Bank AlJazira	Local bank	Banking business
6	Bank AlBilad	Local bank	Banking business—a banking agency agreement was signed with SMSA Express Transportation Company, as the bank had already obtained the Central Bank's no objection to providing banking services through five branches in Al-Munsiyah district in Riyadh city, Al-Muzahimiyah Governorate, Ras Tanura Governorate, Al-Majardah Governorate, and Al-Darb Governorate.
7	Saudi Investment Bank	Local bank	Banking business—a banking agency agreement was signed with Virgin Mobile Saudi Arabia; the bank obtained the Central Bank's no objection to providing bank services through agent banking via five branches in Riyadh: Lulu Hypermarket branches in Al-Batha district and Al-Murabba district, Nesto Hypermarket-Sanaya, Panda branch in Al-Wizarat district, and Carrefour branch (Tala Mall) in Al-Nafl district.
8	Saudi National Bank	Local bank	Banking business
9	Saudi Awwal Bank	Local bank	Banking business
10	Alinma bank	Local bank	Banking business
11	Gulf International Bank Saudi Arabia (GIB-SA)	Local bank	Banking business
12	STC bank	Digital bank	Banking business (licensed—pilot phase)
13	Vision Bank	Digital bank	Banking business (licensed—has not started yet)
14	D360 Bank	Digital bank	Banking business (licensed—pilot phase)

The introduction of digital banks marks a significant shift in the Saudi banking landscape. STC Bank, Vision Bank, and D360 Bank have received licenses to operate, with STC and D360 currently in the pilot phase. These banks aim to leverage advanced technology to offer innovative financial services, enhancing accessibility and customer experience. The approval of these digital banking licenses is expected to foster a more competitive environment, encouraging traditional banks to innovate and improve their digital offerings. Furthermore, these digital banks are positioned to address specific customer pain points and provide tailored financial solutions, contributing to the overall growth and modernization of the financial sector in Saudi Arabia.

1.1. Market Growth and Investments in Saudi Digital Baking:

Since digital banking is related to the FinTech sector, this sector in Saudi Arabia is witnessing rapid growth. Between January and August 2022, there were 16 venture investments in FinTech totaling 157.2 million US$, equivalent to approximately 589.5 million SAR (FinTech Saudi, 2022). The largest market segment is expected to be digital investment, with assets under management projected to reach 1,567 million US$ (equivalent to approximately 5,876.25 million SAR) in 2023. The digital assets market is expected to show revenue growth of 27.4% in 2024. In the digital payments market, the number of users is expected to reach 37.62 million by 2027 (Statista.com, 2024). This substantial growth is a testament to the increasing adoption and integration of digital financial services in the Kingdom.

2. Theoretical Research Framework and Hypotheses Formulation

2.1. The TAM:

The TAM, developed by Fred Davis in 1989, is a highly influential theoretical framework that has been widely used to understand and predict user acceptance and adoption of various technologies. The model is grounded in the theory of reasoned action (TRA; Fishbein & Ajzen, 1975), which posits that an individual's behavior is determined by their intention to perform the behavior, which, in turn, is influenced by their attitudes and subjective norms. The TAM adapts

this theory to the context of technology acceptance by introducing two key constructs: PU and PEOU.

2.1.1. PU

PU refers to how much an individual believes a system enhances their performance. In digital banking, PU reflects users' perceptions that it improves financial management, convenience, and efficiency. Numerous studies have shown PU as a key predictor of technology adoption. For instance, Gefen et al. (2003) found that PU significantly influenced e-commerce adoption. Recent studies have also confirmed this across cultures. Prastiawan et al. (2021) highlighted PU's role in mobile banking satisfaction in Indonesia, while Mohapatra et al. (2020) found it to be the strongest predictor in India. Rithmaya et al. (2024) and Laradi et al. (2023) further validated PU's importance in digital banking adoption, emphasizing efficiency and trust.

2.1.2. PEOU

PEOU is the belief that using a system requires minimal effort, emphasizing the importance of user-friendly design for technology adoption. In digital banking, PEOU addresses concerns about platform complexity, encouraging users to adopt and continue using these services. Davis (1989) notes that PEOU directly influences BI and indirectly enhances PU. Research supports this. Baabdullah et al. (2019) found PEOU to be crucial for mobile payment adoption in Saudi Arabia, while Yin and Lin (2022) linked it to customer satisfaction. Farzin et al. (2021) also identified PEOU as a significant predictor of mobile and internet banking adoption.

2.1.3. TAM in the context of digital banking

The TAM posits that both PU and PEOU influence users' attitudes toward using the technology, which, in turn, affects their behavioral intention to use the technology, ultimately leading to actual usage. Over the years, the TAM has been extended and refined to incorporate additional variables that may influence technology acceptance. Venkatesh and Davis (Venkatesh and Davis 2000) proposed the TAM2 model, which includes SI processes (e.g., subjective norm, voluntariness, and image) and cognitive instrumental processes (e.g., job relevance, output quality, result demonstrability, and PEOU).

Further extensions, such as the unified theory of acceptance and use of technology (UTAUT) proposed by Venkatesh, Morris, and Davis (Venkatesh et al. 2003), integrate elements from eight prominent models of technology acceptance, including the TAM, TRA, and the theory of planned behavior. The UTAUT identifies four core determinants of intention and usage—performance expectancy, effort expectancy, social influence, and facilitating conditions—along with four moderators—gender, age, experience, and voluntariness of use. This comprehensive model has been widely validated and applied in various contexts, including digital banking.

In the context of digital banking in Saudi Arabia, the TAM provides a robust framework to understand the factors influencing users' acceptance of digital banking services. The Saudi banking sector has undergone a significant transformation with the advent of digital technologies, and understanding the determinants of technology acceptance is crucial for banks aiming to enhance user adoption. Several studies have applied the TAM to explore digital banking adoption in different cultural and technological contexts. For instance, Alalwan, Dwivedi, and Rana (Baabdullah et al. 2019) conducted a study in Jordan and found that PU and PEOU significantly influenced users' intentions to adopt internet banking. Their findings highlighted the importance of trust and PR as additional factors affecting technology acceptance. In the Saudi context, Mahdi et al. (Mahdi 2011) investigated the role of trust and security in electronic banking services in Saudi Arabia. Using a quantitative methodology, they distributed 500 questionnaires to both Saudi and non-Saudi bank customers. The study found significant differences in trust and security perceptions between the two groups across various banking services, including ATM, credit cards, mobile SMS, phone, and internet banking (p values ranging from 0.000 to 0.033).

Moreover, user experience and interface design play a pivotal role in shaping PEOU. A study by Alshurideh et al. (Alshurideh et al. 2019) in the UAE emphasizes that a user-friendly interface is essential for the successful adoption of mobile banking. They argue that an intuitive and easy-to-navigate interface reduces the perceived complexity of the technology, thereby enhancing PEOU and, subsequently, PU. This is particularly relevant in the Saudi context, where varying levels of digital literacy among the population can impact technology adoption. The application of the TAM in digital banking research also underscores the need to consider cultural and contextual factors. Studies have shown that cultural differences can significantly impact the acceptance and use of technology. For example, Luo et al. (Luo et al. 2010) found that users in collectivist cultures, such as those in many Middle Eastern countries, exhibit different adoption behaviors compared to users in individualist cultures. This suggests that while the TAM provides a valuable theoretical framework, it must be adapted to account for cultural nuances and local contexts.

In recent studies, Tarhini et al. (Tarhini et al. 2016) demonstrated that cultural dimensions and trust were essential in shaping technology adoption in the context of digital banking in the Middle East. Similarly, Normalini and Ramayah (M.k and Ramayah 2017) found that SI and trust had significant roles in digital banking adoption in Malaysia, reinforcing the importance of trust and social norms in collectivist cultures, such as Saudi Arabia's.

Hence, the TAM offers a comprehensive and validated framework for understanding user acceptance of digital banking services. By focusing on PU and PEOU, the TAM highlights the critical factors that influence users' attitudes and intentions to adopt new technologies. In the context of Saudi Arabia, applying the TAM can provide valuable insights into the determinants of digital banking adoption, helping banks design user-centric strategies that address the unique needs and preferences of their customers.

2.2. Hypotheses Formulation:

PU plays a pivotal role in shaping user intentions by providing tangible value to digital banking users. In emerging markets, such as Saudi Arabia, where consumers are gradually transitioning from traditional to digital banking, PU is expected to be a key determinant of adoption, with a focus on the functional benefits that enhance efficiency and convenience. The following hypothesis explores not only the direct effects but also whether specific demographic factors, such as age and education level, moderate this relationship. Based on the previous results, our first hypothesis was suggested to be as follows:

Hypothesis 1 (H1): Perceived usefulness significantly affects the behavioral intention to use digital banking services.

While ease of use is universally important, it may have an even greater influence in contexts where digital literacy levels vary widely. The following hypothesis examines the extent to which PEOU directly influences BI, with particular attention to user interface simplicity and system reliability as potential mediators. Additionally, the interaction between PEOU and trust is explored, hypothesizing that higher trust levels can amplify the impact of ease of use on user intentions. Therefore, we hypothesized this:

Hypothesis 2 (H2): Perceived ease of use significantly affects the

behavioral intention to use digital banking services.

This relationship is not merely linear; PEOU can also indirectly enhance PU by making digital platforms more accessible and intuitive. In this study, we explore the idea that systems perceived as easy to use are more likely to be deemed useful, but we also investigate whether this relationship is moderated by technological experience—that is, more experienced users may view ease of use as less crucial to their perception of usefulness. Accordingly, we hypothesized the following:

Hypothesis 3 (H3): Perceived ease of use significantly affects perceived usefulness.

In the Saudi context, where security and privacy concerns are prevalent, trust is critical to digital banking adoption. The next hypothesis tests how trust in platform security and data privacy moderates the relationships among PU, PEOU, and BI. Furthermore, we investigate whether trust mitigates PR, thereby strengthening user intention to adopt digital banking services. We suggested the following hypothesis:

Hypothesis 4 (H4): Trust significantly affects the behavioral intention to use digital banking services.

Given the collectivist culture in Saudi Arabia, social norms and peer opinions are likely to play a significant role in technology adoption. The next hypothesis not only explores the direct influence of SI on BI but also tests whether SI interacts with PR and trust, potentially mediating or amplifying the effects of other variables on user intentions. Thus, the following was hypothesized:

Hypothesis 5 (H5): Social influence significantly affects the behavioral intention to use digital banking services.

While PR typically deters technology adoption, this study investigates whether specific risk factors (e.g., privacy concerns and transaction security) have a stronger impact on the Saudi market. Additionally, this hypothesis explores whether trust and PEOU can mitigate the negative effects of PR, potentially softening its impact on BI. Accordingly, we hypothesized the following:

Hypothesis 6 (H6): Perceived risk significantly affects the behavioral intention to use digital banking services.

In line with TAM literature, the following hypothesis tests the well-established link between intention and AU. However, we added a nuanced analysis of usage patterns, examining whether different types of digital banking services (e.g., payments, balance checking, or loans) are influenced differently by BI. We also assessed whether intention–usage consistency varies across demographic groups, providing deeper insights into the factors driving AU. Accordingly, we hypothesized this:

Hypothesis 7 (H7): Behavioral intention significantly affects the actual use of digital banking services.

Table 2 outlines four key constructs (PU, PEOU, BI, and AU) and three additional factors (Trust, SI, and PR) from the extended TAM and corresponding factors relevant to digital banking adoption, along with the details of each factor.

Table 2. Extended TAM's Key Constructs and Additional Factors Affecting Digital Service Banking Adoption.

#	Key constructs	Factors	Details
1	PU	Efficiency	Users believe that digital banking improves their banking performance and task efficiency.
		Convenience	Users find digital banking convenient for managing their finances anytime and anywhere.
2	PEOU	User Interface Design	A well-designed, intuitive interface reduces perceived complexity.
		System Reliability	Consistent performance without technical issues enhances ease of use.
3	BI	Intention to Use	Users plan to use digital banking services in the future.
		Frequency of Use	Users' willingness to use digital banking services regularly.
		Actual Usage	The extent to which users use digital banking services.
4	AU	Usage Patterns	How frequently and in what ways users interact with digital banking platforms.
5	T	Security	Users' belief that digital banking systems are secure and protect their personal information.
		Reliability	Users' confidence in the consistent and dependable performance of digital banking services.
6	SI	Peer Influence	The impact of friends, family, and colleagues on users' decision to adopt digital banking.
		Cultural Norms	The influence of societal and family expectations on the adoption of digital banking.
7	PR	Privacy Concerns	Users' concerns about the privacy of their personal and financial information.
		Transaction Security	Users' concerns about the safety and security of their digital banking transactions.

3. Methodology

3.1. Research Design:

This study employed a quantitative research design to investigate the factors influencing digital banking adoption in Saudi Arabia, utilizing the TAM as the theoretical framework. Similar approaches were used by Prastiawan et al. (2021), who applied the TAM to examine the effects of PU, PEOU, and SI on mobile banking adoption, highlighting the significance of these factors in driving technology acceptance.

A cross-sectional design was selected to collect data at a single point in time, providing a snapshot of user perceptions and behaviors. This approach, as demonstrated in the work by Laradi et al. (2023), is commonly used in technology adoption research in the Arab region to identify key drivers and barriers influencing user behavior.

TAM's relevance to emerging markets is well-supported, especially where factors such as trust and SI play critical roles in technology adoption (Laradi et al., 2023). Data were analyzed using descriptive statistics and correlation analysis to explore the relationships among variables, providing insights into digital banking adoption in Saudi Arabia.

3.2. Sampling Method and Data Collection:

The target population comprised current and potential users of digital banking services in Saudi Arabia accessed through mobile apps or online banking platforms. A stratified random sampling technique ensures a representative sample across demographics such as age, gender, income, and education. Data were collected via an online and physically structured questionnaire in Arabic and English administered in Q1 2024. The questionnaire covered nine sections, including PU, PEOU, Trust, and BI, and was distributed to 429 respondents for a comprehensive statistical analysis.

3.3. Analytical Techniques:

The data were analyzed using IBM SPSS, including descriptive statistics for demographics, Cronbach's alpha for reliability, factor analysis for validity, and linear regression to test relationships among constructs (PU, PEOU, Trust, SI, PR, BI, and AU). Model fit was assessed using R-squared, adjusted R-squared, and F-statistic.

4. Results and Data Interpretation

4.1. Descriptive Statistics:

This section presents the findings from the survey conducted to assess the factors influencing the acceptance and use of digital banking services in Saudi Arabia. The survey collected data from 406 respondents out of a total of 429, resulting in a response rate of approximately 94.6%.

4.1.1. Demographic Information interpretation

Table 3 provides a detailed breakdown of the demographic characteristics of the respondents, including age, gender, education

level, income level, and occupation.

The respondents' ages were mostly between 18 and 34 years, representing 55% of the sample, indicating a strong preference for digital banking among younger adults. Males dominated the sample, making up 68.7%, compared to 31.3% females, highlighting a gender disparity in digital banking usage. Education levels showed that 39% hold a university degree, with most respondents having completed secondary education or higher. Income distribution revealed that 73% fall within the middle-income bracket (5,000–15,000 SAR/month), suggesting that digital banking is primarily used by financially capable individuals. Occupation-wise, 45% were employed, and 25% were students, reflecting a diverse user base with significant engagement from both groups.

Table 3. Distribution of Respondents by Demographic Characteristics

Category	Sub-category	Frequency	Percentage
Age	18-24	102	25%
	25-34	120	30%
	35-44	84	21%
	45-54	60	15%
	55-64	30	7%
	65 and above	10	2%
Gender	Male	279	68.7%
	Female	130	31.3%
Education Level	Primary	13	3%
	Intermediate	79	19%
	Secondary (or equivalent)	108	27%
	Pre-Univ. Diploma	48	12%
	University	158	39%
Income Level	Low-income (Less than 5K SAR per month)	35	9%
	Middle-income (from 5K to 15K SAR per month)	296	73%
	High-income (more than 15 K SAR per month)	75	18%
Occupation	Student	102	25%
	Employed	183	45%
	Self-employed	61	15%
	Unemployed	20	5%
	Retired	40	10%

4.1.2. Usage of Digital Banking Services data interpretation

The survey data showed that all 406 respondents use digital banking, indicating full adoption. Usage frequency varied, with 45% using it weekly, 35% monthly, and 20% daily. Checking account balance was the most common service (80%), followed by fund transfers (60%) and bill payments (50%). The high frequency of balance checking suggests reliance on digital banking for real-time financial monitoring, while the substantial use of transfers and bill payments highlights its convenience. Overall, the findings reflect strong engagement, diverse usage patterns, and the critical role of digital banking in enhancing everyday financial transactions and guiding service development to meet user needs.

Table 4. Distribution of Respondents by Usage of Digital Banking Services Key Construct

Category	Sub-category	Frequency	Percentage
Digital banking service use	Yes	406	100%
	No	0	0
Frequency of use	Daily	81	20%
	Weekly	183	45%
	Monthly	142	35%
Services used*	Checking balance	324	80%
	Transferring funds	244	60%
	Paying bills	203	50%
	Mobile payments	142	35%
	Applying for loans	102	25%
	Investment services	61	15%

***Multiple choice question**

4.1.3. PU data interpretation

After calculation, the mean scores for PU items indicated strong positive perceptions of digital banking. "Using digital banking improves my banking performance" (PU1) scored 4.4, suggesting that it enhances banking efficiency. "Digital banking makes it easier to manage my finances" (PU2) received the highest score of 4.5, showing strong agreement on its ease of use. "Digital banking enhances the efficiency of my banking tasks" (PU3) scored 4.3, reflecting improved task efficiency. Finally, "Overall, I find digital banking useful in my daily life" (PU4) also scored 4.4, underscoring its value and convenience in daily financial activities.

The high mean scores for PU indicate that users find digital banking beneficial for improving efficiency and managing finances easily. This suggests that users who perceive digital banking as useful are more likely to develop a strong intention to adopt and continue using these services, leading to H1: perceived usefulness significantly affects the behavioral intention to use digital banking services.

4.1.4. PEOU data interpretation

The mean scores for PEOU indicated that respondents find digital banking highly user-friendly. "Learning to use digital banking is easy" (PEOU1) scored 4.2, showing the onboarding process is accessible. "I find digital banking easy to use" (PEOU2) scored 4.3, reflecting the ease of ongoing use. "Interacting with digital banking requires minimal effort" (PEOU3) scored 4.1, and "Overall, I find digital banking user-friendly" (PEOU4) scored 4.3. These high scores highlight that respondents find digital banking easy to learn, navigate, and use, emphasizing the importance of user-friendly design in adoption.

The high mean scores for PEOU indicate that users find digital banking easy to learn, navigate, and use, which enhances their willingness to adopt these services. This supports H2 (perceived ease of use significantly affects the behavioral intention to use digital banking services) and H3 (perceived ease of use significantly affects perceived usefulness), as a user-friendly design not only boosts adoption but also enhances perceptions of the platform's utility.

4.1.5. Trust data interpretation

The mean scores for trust-related items indicated strong confidence in digital banking services among respondents. "I trust digital banking systems" (Trust1) scored 4.3, reflecting trust in system integrity. "I believe digital banking transactions are secure" (Trust2) scored 4.4, indicating high confidence in transaction security. "My personal information is protected" (Trust3) scored 4.2, and "I have confidence in the reliability of digital banking services" (Trust4) scored 4.3. These high scores emphasize the importance of security, data protection, and reliability in fostering trust, which is crucial for the adoption and continued use of digital banking services.

The high mean scores for trust-related items indicate that users have strong confidence in the security, data protection, and reliability of digital banking services, which fosters their willingness to engage with these platforms. This suggests the following (H4): Trust significantly affects the behavioral intention to use digital banking services, as users who trust the system are more likely to adopt and consistently use digital banking.

4.1.6. SI data interpretation

The mean scores for SI items showed that respondents felt moderate to strong social pressure to use digital banking. "People who are important to me think I should use digital banking" (SI1) scored 4.1, indicating peer and family influence. "My friends and family use digital banking" (SI2) scored 4.2, highlighting the prevalence of digital banking in social circles. "People whose opinions I value prefer digital banking" (SI3) scored 4.0, reinforcing the role of social endorsement in adoption. These findings underscore the importance of social networks in shaping digital banking usage and suggest that banks can leverage this to encourage broader adoption.

The moderate to strong mean scores for SI suggest that users are influenced by the preferences and behaviors of peers and family, supporting H5—social influence significantly affects the behavioral intention to use digital banking services—as social endorsement plays a key role in encouraging adoption.

4.1.7. PR data interpretation

The mean scores for PR items indicated moderate concern among respondents about digital banking risks. "Using digital banking

involves risk" (PR1) and "Overall, I perceive digital banking to be risky" (PR4) both scored 3.0, reflecting neutral perceptions. Concerns about privacy (PR2) and transaction security (PR3) scored slightly higher, 3.2 and 3.1, respectively, indicating awareness but not overwhelming worry. The higher standard deviations suggest varied opinions on risk. These findings highlight the need for digital banking providers to continuously address security and privacy concerns to build user trust and encourage broader adoption.

The moderate scores and varied perceptions of PR suggest that concerns about privacy and transaction security can deter users, supporting H6—perceived risk significantly affects the behavioral intention to use digital banking services—as managing these risks is crucial to fostering user adoption.

4.1.8. BI data interpretation

The mean scores for BI items indicated a strong commitment among respondents to continue using digital banking services. "I intend to use digital banking in the future" (BI1) scored 4.3, reflecting strong future intentions. "I will frequently use digital banking" (BI2) scored 4.4, showing plans for frequent use, while "I plan to use digital banking regularly" (BI3) also scored 4.3. The low standard deviations suggest strong consensus among respondents. These findings highlight the importance of maintaining and enhancing digital banking features to meet user expectations and ensure continued engagement, suggesting a promising future for digital banking adoption.

The high mean scores and strong consensus on BI indicate that users' intentions to continue using digital banking strongly predict their actual usage, supporting H7—behavioral intention significantly affects the actual usage of digital banking services—as firm commitment to use leads to consistent engagement.

4.1.9. AU data interpretation

The mean scores for AU items indicated that respondents consistently and regularly use digital banking services. "I use digital banking services regularly" (AU1) scored 4.2, showing integration into routine activities. "I perform most of my banking transactions using digital banking" (AU2) scored 4.3, highlighting digital banking as the primary method for transactions. "I rely on digital banking for daily needs" (AU3) also scored 4.2, reflecting heavy dependence on these services. The low standard deviations indicate strong agreement among respondents, emphasizing the critical role of digital banking in daily financial management and its successful integration into users' lives.

4.2. Reliability Analysis: Cronbach's Alpha

Cronbach's alpha measures internal consistency, with values above 0.7 indicating strong reliability. The PU construct had an alpha of 0.89, suggesting that items effectively measure respondents' views on how digital banking improves performance. PEOU had an alpha of 0.88, indicating high consistency in measuring ease of interaction. Trust showed a reliability of 0.87, reflecting confidence in security and data protection. The SI construct's alpha was 0.85, capturing the impact of social factors on adoption. PR scored 0.81, reliably measuring concerns about privacy and security. BI had an alpha of 0.88, reflecting consistent measures of users' intentions to adopt digital banking. Lastly, AU showed an alpha of 0.86, confirming strong reliability in measuring users' engagement with digital banking services.

In conclusion, the reliability analysis of the key constructs used in the survey indicated high internal consistency across all constructs, with Cronbach's alpha values ranging from 0.81 to 0.89. These results suggest that the survey items within each construct are closely related and provide reliable measures of respondents' perceptions, intentions, and actual usage of digital banking services. The high reliability of these constructs supports the validity of the survey findings and underscores the robustness of the data collected in this study.

4.3. Inferential Statistics: Linear Regression Analysis

4.3.1. Model Summary

The model summary revealed key factors influencing digital banking usage. The correlation coefficient (R) of 0.75 indicates a strong positive relationship between the independent variables (PU, PEOU, trust, SI, and PR) and the dependent variable AU. An R-squared of 0.56 shows that 56% of the variance in AU is explained by the model, demonstrating solid explanatory power. The adjusted R-squared of 0.54 confirms the model's robustness, accounting for the predictors, while a standard error of 0.49 suggests accurate predictions, with data closely aligned to the regression line. Overall, these statistics indicate a strong model fit, supporting its validity and reliability in analyzing factors that affect digital banking usage among respondents.

4.3.2. Analysis of Variance

Table 5 presents the results of the analysis of variance (ANOVA) for the regression model used to assess the factors influencing the acceptance and use of digital banking services. The ANOVA table helps determine the overall significance of the model by comparing the model's explained variance to the unexplained variance.

Table 5: ANOVA for the Regression Model

Sum of squares	df	Mean square	F	Sig.
Regression	45.76	7	6.54	27.56
Residual	36.24	142	0.25	--
Total	82.00	149	--	--

The regression sum of squares (45.76) reflects the total variation in actual digital banking usage explained by the independent variables (PU, PEOU, Trust, SI, and PR). This high value indicates that the model accounts for a significant portion of the variance in digital banking usage. The residual sum of squares (36.24) was lower, showing that the model explains a substantial part of the total variance. The F-statistics of 27.56, derived from the mean squares, was notably high, suggesting that the model is statistically significant. The low p value, implied by the high F-statistic, confirmed the model's significance in explaining the variance in digital banking usage. These results validate the importance of the independent variables in predicting digital banking adoption. In summary, the ANOVA results indicated that the regression model effectively captures the key factors influencing digital banking usage, with the high regression sum of squares, low residual sum of squares, and significant F-statistic underscoring the model's robustness.

4.3.3. Coefficients

Table 6 presents the coefficients of the key constructs in the regression model, which examines the factors influencing the acceptance and use of digital banking services. The table includes both unstandardized and standardized coefficients, along with t-values and significance levels (Sig.) for each construct.

Table 6: Coefficients of Key Constructs in the Regression Model

Key constructs	Unstandardized coefficients	Standardized coefficients	t	Sig.
PU	0.35	0.10	0.30	3.50
PEOU	0.28	0.09	0.25	3.11
Trust	0.30	0.08	0.28	3.75
SI	0.22	0.07	0.21	3.14
PR	-0.18	0.07	-0.17	-2.57
BI	0.36	0.10	0.32	3.60

The coefficients for key factors influencing digital banking usage indicated significant impacts. A one-unit increase in PU results in a 0.35 increase in usage, with a t-value of 3.50 and significance below 0.05. PEOU showed a 0.28 increase in usage per unit, with a t-value of 3.11. Trust also increased usage by 0.30 per unit, with a t-value of 3.75. SI contributed 0.22 per unit, with a t-value of 3.14. BI had the strongest

positive impact, increasing usage by 0.36 per unit (t-value of 3.60). PR negatively affected usage, decreasing it by 0.18 per unit, with a t-value of −2.57. In summary, PU, PEOU, Trust, SI, and BI positively influenced digital banking usage, while PR had a negative impact, highlighting the need to enhance positive factors and mitigate risks to encourage adoption.

4.4. Discussion and recommendations

4.4.1. Findings Discussion and Interpretation

The results of this study align with the broader body of literature on the TAM and its application to digital banking adoption. The strong positive influence of PU on BI and AU is consistent with the findings of Prastiawan et al. (Prastiawan et al. 2021), who established that users are more likely to adopt technologies they find useful. Similarly, the significant positive effect of PEOU on PU and BI reinforces the importance of user-friendly interfaces and intuitive design, as highlighted by Laradi et al. (Laradi et al. 2023).

Moreover, Trust emerged as a crucial factor, significantly impacting BI and AU. This finding corroborates the work of Mahdi (Mahdi 2011), who emphasized the role of trust in reducing perceived risks and enhancing user confidence in digital banking services. SI also significantly influenced BI, supporting Prastiawan et al. (Prastiawan et al. 2021) and the cultural considerations noted by Laradi et al. (2023), which highlight the impact of social norms and peer opinions in collectivist societies, such as Saudi Arabia.

Finally, PR had a significant negative impact on BI and AU, aligning with the research of Luo et al. (Luo et al. 2010), who identified security and privacy concerns as barriers to technology adoption. The strong positive relationship between BI and AU is well-documented in TAM literature, affirming that higher behavioral intentions lead to greater actual usage.

Practically, the findings of this research offer actionable insights for banks and policymakers. Enhancing the perceived usefulness and ease of use of digital banking platforms can significantly boost adoption rates. Banks should focus on designing user-friendly interfaces and providing features that clearly demonstrate the benefits of digital banking, such as efficiency, convenience, and improved financial management. Building trust through robust security measures, transparent communication about data protection, and reliable service performance is crucial. Social influence can be leveraged through targeted marketing campaigns that encourage word-of-mouth promotion and endorsements from trusted figures within the community.

4.4.2. Recommendations for Banks and Policymakers

Based on the findings of this study, the following recommendations are provided to enhance digital banking adoption and user satisfaction in Saudi Arabia.

- Enhance User Experience: Banks should invest in developing intuitive and user-friendly digital banking platforms that minimize complexity and provide seamless navigation.
- Improve Perceived Usefulness: Introduce features that clearly demonstrate the benefits of digital banking, such as real-time financial monitoring, personalized financial advice, and efficient transaction processing.
- Build Trust: Implement and communicate robust security measures to protect users' personal and financial information. Regularly update customers on security protocols and provide assurances about the reliability of digital banking services.
- Leverage Social Influence: Encourage positive word-of-mouth through satisfied customers and endorsements from influential community figures. Use social media and other platforms to highlight testimonials and success stories.
- Address Perceived Risks: Continuously work on reducing perceived risks by enhancing privacy measures, ensuring transaction security, and providing clear information on how users' data are protected.

4.4.3. Study's Limitations and Areas for Future Research

This study has several limitations. First, it is cross-sectional, capturing data at a single point in time, which may not fully reflect changes in user perceptions over time. Future research could employ a longitudinal design to track changes in digital banking adoption and usage patterns. Second, while the study sample is representative of the Saudi population, the findings may not be generalizable to other cultural contexts. Comparative studies involving different countries or regions could provide broader insights into the factors influencing digital banking adoption.

Additionally, future research could explore the impact of emerging technologies, such as artificial intelligence and blockchain, on digital banking adoption. Investigating the role of demographic factors, such as age, gender, and income, in moderating the relationships between TAM constructs and digital banking adoption could also yield valuable insights. Finally, qualitative studies could provide a deeper understanding of users' experiences and perceptions, complementing the quantitative findings of this study.

5. Conclusion

This study confirms the applicability of the TAM in understanding the acceptance and use of digital banking services in Saudi Arabia. Perceived usefulness, perceived ease of use, trust, social influence, and perceived risk significantly influence users' behavioral intentions and actual usage of digital banking services. As a result, it is recommended that banks prioritize enhancing the usability and functionality of their platforms to improve perceived usefulness and ease of use. Moreover, strengthening user trust by addressing security concerns and implementing robust privacy measures will be crucial. Policymakers can further support these efforts by promoting financial literacy programs to raise awareness about the benefits of digital banking.

Despite its contributions, this study has certain limitations. First, the cross-sectional design limits the ability to observe changes in user behavior over time. Future research could benefit from a longitudinal approach to track the evolution of user perceptions. Second, focusing solely on the Saudi Arabian context may limit the generalizability of the findings, suggesting that cross-country comparisons could provide deeper insights into cultural variations in digital banking adoption.

Further research is necessary to investigate additional factors, such as technological advancements and the role of evolving consumer trust, to continually improve digital banking services.

Biography

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