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Determinants of digital banking adoption in the Kingdom of Saudi Arabia: A technology acceptance model approach

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ABSTRACT

This study aims at investigating the determinants of digital banking adoption in the Kingdom of Saudi Arabia using the Technology Acceptance Model (TAM). The study is based on data from the 2017 Global Financial Inclusion Survey covering 1009 respondents, which has been analysed using simple analytical tools such as the chi-square test and logistics regression. About 51.5% of respondents reported adoption of digital banking in Saudi Arabia. The factor of trust in digital banking has been added to extend the Technology Acceptance Model (TAM) in predicting digital banking technology adoption. The two constructs of the Technology Acceptance Model (TAM) i.e. perceived ease of use (PEOU) and perceived usefulness (PU), show a significant and positive marginal effect on the adoption of digital banking, whereas trust indicates a negative and significant marginal impact with controlling effect of age and education of the consumers. This study provides valuable insights for financial institutions, consumers, business entities and researchers in promoting the digital banking system in Saudi Arabia.

1. Introduction

The information technology revolution in the banking sector has transformed the financial services experience for its customers across the globe (Ahmed & Sur, 2021; Chauhan, Akhtar, & Gupta, 2022; Liébana-Cabanillas & Lara-Rubio, 2017). Technology innovation in terms of automated teller machine (ATM), internet banking, mobile banking, digital banking kiosks, Unified Payments Interface (UPI) has introduced new mechanisms that are capable of enhancing the capabilities of banking sector to cater to the needs of their customers in a more effective and efficient way (Glavee-Geo, Shaikh, Karjaluoto, & Hinson, 2020; Kaur, Ali, Hassan, & Al-Emran, 2021; Shaikh & Karjaluoto, 2015). With the advent of the internet, the banking system has been incited to reconsider its informational technology strategies and is now faced with an increased challenge of conducting the marketing and promotion of its products using the internet as a platform (Al-Qeisi & Hegazy, 2015; Chau & Lai, 2003). Significant changes have also been seen in the delivery of services in the banking sector, particularly the growth of digital and mobile banking services (Alkhowaiter, 2020; Glavee-Geo, Shaikh, & Karjaluoto, 2017; Hanafizadeh, Keating, & Khedmatgozar, 2014; Karjaluoto, Shaikh, Saarjärvi, & Saraniemi, 2019). A recent report by McKinsey & Company (2021) indicates that

emerging markets are growing rapidly in terms of digital banking innovation and adoption.

This technological transformation of the banking sector has invited a lot of deliberation by researchers in recent times, and several studies have been conducted to study the significant growth of digital banking in recent years (Kaur et al., 2021; Ligon, Malick, Sheth, & Trachtman, 2019; Mhlanga, 2020). Earlier research was mainly directed toward studying the introduction and growth of digital banking across various countries (Abu-Shanab & Pearson, 2009; Howcroft, Hamilton, & Hewer, 2002). Recent studies have examined the factors affecting the adoption of digital banking across different countries (Montazemi & Qahri-Saremi, 2015; Zins & Weill, 2016; Ege Oruç and Tatar, 2017; Alalwan, Dwivedi, Rana, & Algharabat, 2018; Matthews, 2019; Mukhopadhyay, 2021). Digital banking benefits the customers and enables the banks to undertake improved and speedy delivery of financial products and reduce transactional costs, thereby increasing their profitability, saving costs and providing better overall service to their customers (Dash, Mohanty, Pattnaik, Mohapatra, & Sahoo, 2011). It allows the customers to avail banking services such as checking balances and carrying out transactions like transferring funds and stock trading (Nasri, 2011) from anywhere, without physically visiting the banks. Online banking is also instrumental in supporting e-commerce platforms

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by enabling transactions through electronic means (Lee, 2009; Shaikh & Karjaluo, 2015).

A vast disparity is seen in the implementation and penetration of digital banking in different countries due to differences in national culture across regions and countries (Qureshi, Zafar, & Khan, 2008; Takeddine & Sun, 2015; Yousafzai & Yani-de-Soriano, 2012). Moreover, regardless of the widespread popularity and many benefits of digital banking, some obstacles hinder its adoption (Pikkarainen, Pikkarainen, Karjaluo, & Pahlila, 2004), such as the lack of access to an internet connection, lack of social and personal touch in availing the services (Mattila, Karjaluo, & Pentto, 2003), and security issues (Sathye, 1999). A very pertinent problem faced by the banking sector is the security risk associated with digital transactions, which can lead to substantial financial losses (Ivan, Ciurea, Doinea, & Avramiea, 2012). Ege Oruç and Tatar (2017) argued that internet banking's success depends on the government's support and the customers' acceptance of it. Daneshgadeh and Yildirim (2014) determined from their research that customers only use internet banking if they recognise it to be useful for them, and for effective usage of internet banking, it must be compatible with the personal and professional life of the customer.

In this study, online banking or digital banking refers to undertaking various banking services through an online platform, such as bill payments and investments (Leong, Hew, Ooi, & Chong, 2020; Windasari, Kusumawati, Larasati, & Amelia, 2022). Sathye (2005) defines Transactional Digital Banking as a range of activities that bank customers can undertake online, particularly the transfer of funds from one account to another, as per their convenience of place and time. In the context of the Kingdom of Saudi Arabia, very few studies have tried to gauge the factors affecting the adoption of digital banking (Alkhowaiter, 2020; Alsheikh & Bojei, 2014; Jehan & Ansari, 2018). Moreover, even fewer studies have analysed the effect of trust and demographic variables on the adoption of online banking. Earlier studies have also focused on merely testing correlational instead of causal relationships among the determinants of digital financial services adoption (Karjaluo et al., 2019). In order to fill this gap, this study investigates the factors affecting the adoption of internet banking in the Kingdom of Saudi Arabia using the Technology Acceptance Model (TAM), comprising of three components, namely, perceived ease of use (PEOU), perceived usefulness (PU) and trust in digital banking. Results of the study can help the Saudi banking sector in understanding the customers' behavioural intent, enabling them to formulate better strategies for effective and efficient delivery of financial services through the online platform. The study will help to understand the elements that affect the adoption of digital banking in Middle-Eastern countries, which can be further extended in future research to enhance theoretical and scholarly contributions.

This paper is organized into 6 sections. After the introduction, Section 2 provides a review of literature related to digital banking and the conceptual research framework, followed by section 3, which comprises of data and methods used in this study, including details of the survey instrument, variables used in the study, and data analysis techniques. Findings of the data analysis constitute section 4, followed by section 5, which includes a discussion on the results. Finally, the last section consists of conclusion, limitations of the study, and future research direction.

2. Literature review and conceptual framework

Several studies have been conducted over the years to understand the factors that affect the adoption of digital banking among customers, using different behavioural models. The most popular models include the Theory of Reason Action (Fishbein & Ajzen, 1975), Technology Acceptance Model (Davis, 1989), Theory of Planned Behaviour (Ajzen, 1991), Extended Technology Acceptance Model (TAM2) (Venkatesh & Davis, 2000), and Unified Theory of Acceptance and Use of Technology (Venkatesh, Morris, Davis, and Davis (2003). Among the above models,

the Technology Acceptance Model (TAM) is most commonly and extensively used for predicting the adoption and usage of digital banking among customers and has been found to be valid and reliable in different situations and with varied samples (Davis, 1989). According to Davis, the success of a technology adoption largely depends upon the attitude and perception of the user about it, which in turn depends upon the ease or difficulty faced by a user while using the technology in question. TAM has been extensively used in a number of studies and has been found to consistently explain around 40% of the variance in usage intentions and behaviour (Karjaluo, Glavee-Geo, Ramdhony, Shaikh, & Hurpaul, 2021; Shaikh & Karjaluo, 2015).

As per the model, the significant factors that influence technology adoption are perceived usefulness and perceived ease of use; although several other constructs have also been covered by researchers in recent studies under this model, such as trust on the technology, social influences, demographic factors, perceived impediments etc. Chau and Lai (2003) argued that the technology setting of the digital banking environment is completely different from other conventional businesses, hence existing Technology Acceptance Model is inadequate in explaining the adoption of digital banking. Gefen, Karahanna, and Straub (2003) used a TAM and Trust model by incorporating trust as an additional variable in the Technology Acceptance Model, which they found to be influencing the adoption of online technology significantly.

In the present study, the variables affecting the adoption of digital banking in the Kingdom of Saudi Arabia have been taken from the Global Findex Database (2017), according to the Technology Acceptance Model (TAM) requirement, namely, perceived ease of use (PEOU) and perceived usefulness (PU). In addition, the model has been extended to include trust as an additional variable. Demographic variables like gender, age, education, occupation, and income have been transformed and utilised as control variables in the study.

2.1. Demographic characteristics

Safeena, Kammani, and Date (2014) concluded from their study that demographic factors like gender and age moderated the TAM model in addition to perceived benefits and social influence. Al-Somali, Gholami, and Clegg (2009), in addition to other factors, found education to be significantly influencing the attitude toward adopting online banking in Saudi Arabia. Jaruwachirathanakul and Fink (2005) conducted a study on customers in Thailand and found that education, income, and gender significantly moderate digital banking adoption. In a study on the adoption of internet banking in Tunisia, Nasri (2011) established that occupation has a significant impact on the adoption of online banking services, while Kolodinsky, Hogarth, and Hilgert (2004) in their study conducted in the USA, found income and education to be having a positive impact on the likelihood of adoption of electronic banking services.

Polasik & Wisniewski (2009) concluded from their study that age, gender and education level significantly affected the adoption of internet banking among Polish customers. Mirza, Beheshti, Wallström, and Mirza (2009) concluded that gender and occupation greatly influence internet banking adoption in their study conducted among Iranian customers. Alabdian (2017) conducted a study in Saudi Arabia to study the adoption of digital banking among females and found that in addition to other variables, education, age, and professional background affected the adoption of digital banking among Saudi females. In view of the available literature, the following hypothesis is proposed:

H1. There is a significant association between the adoption of digital banking and the demographic characteristics of customers.

To capture the association between demographic variables and digital banking adoption, the sub-hypotheses of H1 have been formulated and tested as follows:

H1a. There is a significant association between the adoption of digital

banking and the age of customers.

H1b. There is a significant association between the adoption of digital banking and the education level of customers.

H1c. There is a significant association between the adoption of digital banking and the working status of customers.

H1d. There is a significant association between the adoption of digital banking and the household income of customers.

2.2. Perceived ease of usage

Perceived ease of use (PEOU) is defined as ‘the degree to which a person feels that he will be free from efforts while using a particular system’ (Davis, 1989). In the context of digital banking, perceived ease of usage will refer to a user’s perception regarding the ease of use of banking systems and procedures. Celik (2008) in their study on Turkish customers, determined that ease of use plays a major and direct role in determining the adoption of digital banking. Al-Somali et al. (2009) used the Technology Acceptance Model (TAM) to study the factors that influence the adoption of online banking in Saudi Arabia and found that perceived ease in usage and perceived usefulness were essential determinants of the adoption of online banking; and these were in turn affected by factors like internet quality, customer awareness of online banking, computer self-efficacy and social influence. Similarly, the results of a study conducted by Amin (2009) also highlighted a positive influence of perceived ease of usage on online banking in Malaysia. In addition to these studies, a number of other researchers have found perceived ease of use to be positively associated with customers’ online banking adoption intention (Bashir & Madhavaiah, 2015; Dash et al., 2011; Yoon & Barker Steege, 2013). In view of the reviewed literature, this study proposes the following hypothesis:

H2. Perceived Ease of Use (PEOU) positively affects the customers’ adoption of digital banking.

2.3. Perceived usefulness

Perceived usefulness (PU) is defined as the ‘degree to which a person feels that using a particular system would improve or enhance his/her job performance’ (Davis, 1989). In the context of digital banking, perceived usefulness will refer to the perception of a user regarding whether using a banking system would increase or improve his productivity. Tan, Chong, Ooi, and Chong (2010) concluded that perceived usefulness positively correlates with online banking adoption. In their study on bank customers in Estonia, they found perceived usefulness to be the most significant variable determining the adoption of digital banking. Amin (2009) used the Technology Acceptance Model (TAM) in a study conducted on Malaysian customers and found perceived usefulness to be an important factor influencing the adoption of online banking.

Bashir and Madhavaiah (2015) conducted a study on internet banking adoption in India using the Technology Acceptance Model (TAM) and found that perceived usefulness directly affects the adoption of online banking technology. Other studies undertaken by Jaruwachirathanakul and Fink (2005), Yiu, Grant, and Edgar (2007), Celik (2008), Al-Somali et al. (2009), Chong, Ooi, Lin, and Tan (2010), Yoon and Barker Steege (2013), have validated the positive effect of perceived usefulness on digital banking adoption. Hence, we propose the following hypothesis:

H3. Perceived Usefulness (PU) positively affects the customers’ adoption of digital banking.

2.4. Trust

Trust can be defined as ‘a person’s confidence in his or her

anticipation of what the other person will do based on their earlier interactions, although the expected behaviour of the other person is not guaranteed’ (Gefen, 2000). Trust was first used as an additional variable influencing the adoption of internet banking by Suh & Han (2002). They postulated that perceived ease of use and perceived usefulness might not fully explain the customers’ behaviour in the ever-evolving digital banking environment. They stressed that trust becomes all the more important in the context of digital banking, as internet banking is risky from the point of view of security. Results of their study confirmed that trust had a significant impact on digital banking adoption. Similarly, Alsajjan and Dennis (2010), in a comparative study between the UK and Saudi Arabia on user acceptance of internet banking, stressed the need to include trust as a variable in the TAM model for robustness. Their study found that trust favourably affects the adoption rate of digital banking.

Yousafzai, Pallister, and Foxall (2009) stressed that the ability of a bank to undertake digital banking depends upon its trustworthiness to the customers. More studies conducted to study the factor affecting the adoption of digital banking using the Technology Acceptance Model (TAM) have found trust to be positively associated with customers’ online banking adoption intention (Al-Somali et al., 2009; Bashir & Madhavaiah, 2015; Chong et al., 2010; Reid & Levy, 2008; Tan et al., 2010). Keskar and Pandey (2018) reviewed digital banking literature and found that trust has been widely used in many studies as an important variable affecting the adoption and use of digital banking. Based on the literature surveyed, we propose the following hypothesis:

H4. Trust has a positive effect on customers’ adoption of digital banking.

Fig. 1 highlights the Technology Acceptance Model (TAM) for digital banking. The model consists of three factors that we suggest to be affecting the adoption of digital banking in the Kingdom of Saudi Arabia: perceived ease of usage, perceived usefulness, and trust. The demographic characteristics of the users have been taken as control variables.

3. Data and methods

3.1. Survey data

This study is based on the 2017 Global Findex database, drawn from a global financial inclusion survey conducted in 144 countries representing >97% of the world’s population, and covering 150,000 respondents. The survey aimed at understanding how people worldwide acquired and used financial institutions and products. The Global Findex covered >200 indicators on issues related to financial inclusion like holding a bank account, payments, savings, credit, digital banking, digital technologies and financial security. A total of 1009 respondents from the Kingdom of Saudi Arabia of the age of 15 years and above were

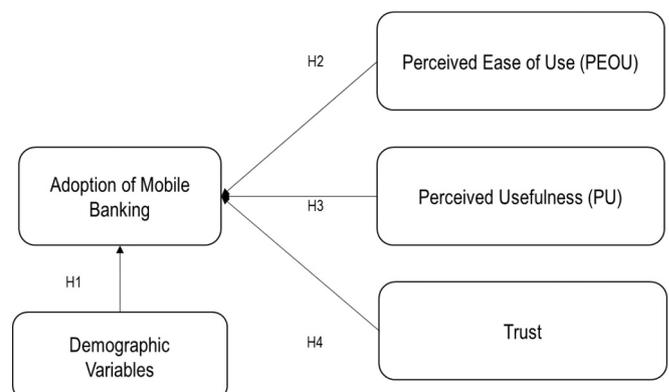


Fig. 1. Technology Acceptance Model (TAM) for digital banking.

surveyed in the calendar year 2017 by Gallup, Inc. as part of its Gallup World Poll. A telephonic survey was conducted by covering the respondents who were able to respond in Arabic or English. A multi-stage random sampling technique has been used to identify the representative samples. The primary sampling units have been identified at the first stage, which has been stratified by population size, geography, or both, and clustering. Finally, households were selected using random route procedures. The survey was conducted using a structured 2017 Global Findex Questionnaire. A set of questions related to digital banking were extracted from the survey. The responses of these variables were recorded as Yes or No. Further, a set of demographic variables have also been shortlisted from the survey.

3.2. Definition of variables

The variables related to the adoption of digital banking have been extracted from the Global Findex survey as per the requirement of the Technology Acceptance Model (TAM). TAM comprises of two components, namely perceived ease of usage and perceived usefulness. The model has been extended in the present study to include trust in digital banking technology as the third variable affecting technology adoption. Digital banking is one of the advancements of recent time, which has revolutionised the banking system and customer service globally. The response on the adoption of digital banking has been used as the dependent variable, which has been recorded as Yes = 1 and No = 0. The use of a mobile phone or the internet to access FI accounts provides ease to the customers in using digital banking, which has also been recorded as Yes = 1, Otherwise = 0. The usefulness of digital banking has been captured with the help of survey responses on the usage of digital banking for receiving payment of wages, salaries and government transfers and recorded as Yes = 1, Otherwise = 0. Similarly, customers' trust in digital banking has been recorded if they trust digital banking technology. Further, a set of demographic variables like gender, age, education, occupation, and income have been transformed and utilised as control variables in the study. The definition of variables and descriptive statistics is given in Table 1.

3.3. Data analysis

The data extracted from the Survey has been analysed using simple statistical techniques such as descriptive statistics, chi-square test, correlation matrix and logistics regression. Descriptive statistics have been used to understand the basic nature of the variables. Chi-square test has been used to assess the association between demographic characteristics of the respondents and the adoption of digital banking among the adult population in Saudi Arabia. Finally, the marginal effect has been estimated using the Technology Acceptance Model (TAM). The logistics regression equation is given as follows:

$$DB_i^{TAM} = \ln\left(\frac{P_i}{1 - P_i}\right) = \alpha + \sum_{i=1}^n \beta_i X_i$$

Where, $P_i = 1$, if the respondents adopt digital banking; $P_i = 0$, if the respondents do not adopt digital banking; α is the intercept; β_i is the vector of coefficients; X_i is the vector of independent and control variables.

4. Results

4.1. Demographic profile of the respondents by adoption of digital banking

The demographic profile of the respondents includes gender, age, education level, occupation and income, which are presented in Table 2. About 51.5% of the respondents have reported adoption of digital transactions in Saudi Arabia. Results of Chi-square test statistics reveal

Table 1
Definition of variables and descriptive statistics.

| Variables | Description | Minimum | Maximum | Mean | Std. Deviation |
|------------------------------|--|---------|---------|------|----------------|
| Dependent variable | | | | | |
| Digital Banking | Adoption of Digital Banking (1 Yes, 0 Otherwise) | 0 | 1 | 0.52 | 0.500 |
| Explanatory variables | | | | | |
| Perceived Ease in Usage | Used mobile phone or digital to access FI account (1 Yes, 0 Otherwise) | 0 | 1 | 0.31 | 0.464 |
| Perceived Usefulness | Paid utility bills through a mobile phone (1 Yes, 0 Otherwise) | 0 | 1 | 0.26 | 0.386 |
| Trust | Trust in banking (1 Yes, 0 Otherwise) | 0 | 1 | 0.31 | 0.439 |
| Demographic variables | | | | | |
| Gender | 1 if the respondent is male, 0 otherwise | 0 | 1 | 0.36 | 0.480 |
| Age | 1 if the respondent is between 15 and 24 years of age, 0 otherwise | 0 | 1 | 0.27 | 0.442 |
| Employment | 1 if the respondent is in the workforce, 0 otherwise | 0 | 1 | 0.78 | 0.417 |
| Education | 1 if the respondent completed secondary & above education, 0 otherwise | 0 | 1 | 0.92 | 0.266 |
| Income | 1 if income is in middle & above, 0 otherwise | 0 | 1 | 0.58 | 0.494 |

Source: Authors' calculations based on Global Financial Inclusion (GFI) Database 2017.

that there is a significant and positive association between the adoption of digital banking and all the demographic characteristics of the respondents (Table 2). As evident from Table 2, the gender distribution shows that out of the total adopters, 72.3% were males while 27.7% were females. This shows that more males have adopted digital banking as compared to their female counterparts ($\chi^2 = 31.967, P < 0.01$). The Chi-square estimates indicate a statistically significant association between age and digital banking adoption ($\chi^2 = 9.762, P < 0.01$). The age profile shows that majority of the digital banking adopters (69.4%) were belonging to the age group of 25–49 years. On the other hand, 24.4% of the adopters fell in the age group of below 25 years whereas 6.2% were above 49 years of age.

Similar, a significant association has been found between education and digital banking adoption ($\chi^2 = 55.941, P < 0.01$). The educational profile indicates that the majority of the adopters, i.e. 51.3%, had

Table 2
Demographic profile of the respondents by adoption of digital banking.

| Demographic profile | Yes | | No | | Chi-square | df | Sig. |
|----------------------------------|-----|------|-----|------|------------|----|-------|
| | N | % | N | % | | | |
| Gender | | | | | 31.967** | 1 | 0.000 |
| Male | 376 | 72.3 | 270 | 55.2 | | | |
| Female | 144 | 27.7 | 219 | 44.8 | | | |
| Age | | | | | 9.762** | 2 | 0.008 |
| < 25 years | 127 | 24.4 | 141 | 28.8 | | | |
| 25–49 years | 361 | 69.4 | 298 | 60.9 | | | |
| > 49 years | 32 | 6.2 | 50 | 10.2 | | | |
| Education level | | | | | 55.941** | 2 | 0.000 |
| Completed primary or less | 15 | 2.9 | 62 | 12.7 | | | |
| Secondary | 267 | 51.3 | 290 | 59.3 | | | |
| Completed tertiary or more | 238 | 45.8 | 137 | 28.0 | | | |
| Occupation | | | | | 45.150** | 1 | 0.000 |
| Out of workforce | 72 | 13.8 | 154 | 31.5 | | | |
| In workforce | 448 | 86.2 | 335 | 68.5 | | | |
| Household income quartile | | | | | 33.667** | 4 | 0.000 |
| Poorest 20% | 64 | 12.3 | 113 | 23.1 | | | |
| Second 20% | 86 | 16.5 | 98 | 20.0 | | | |
| Middle 20% | 98 | 18.8 | 86 | 17.6 | | | |
| Fourth 20% | 115 | 22.1 | 103 | 21.1 | | | |
| Richest 20% | 157 | 30.2 | 89 | 18.2 | | | |

Source: Authors' calculations based on Global Financial Inclusion (GFI) Database 2017.

**significant at 0.01 level; *significant at 0.05 level.

achieved a tertiary or higher level of education, whereas, 45.8% had completed secondary level education. Very few adopters were found to be having primary level or lesser education. The occupational profile also shows a significant association with digital banking adoption ($\chi^2 = 45.150, P < 0.01$). It is evident that 86.2% of adopters were employed and 13.8% adopters were unemployed. As far as household income level is concerned, the result reveals a significant association with digital banking ($\chi^2 = 33.667, P < 0.01$). Income distribution shows that 30.2% respondents belonged to the richest income quartile, 22.1% were from the fourth income quartile, 19.6% belonged to the third income quartile, 16.5% were from second percent quartile, whereas only 12.3% adopters were from the poorest quartile.

Therefore, hypothesis H1, which assumed that there is a significant association between adoption of digital banking and demographic characteristics of customers is accepted. The sub-hypotheses of H1a, H1b, H1c, and H1d for gender, age, education level, occupation and income respectively are also accepted. As evident from Table 2, the rate of adoption of digital banking is more in case of males as compared to females. Regarding age statistics, customers in the age group of 25–49 years are more likely to adopt digital banking. Analysis of educational profile shows that adoption rate will be higher in case of people who have received tertiary or more level of education, followed by those who have completed secondary level of education. Occupation profile reveals that employed people are more likely to adopt digital banking as compared to those who are unemployed. Household income statistics reveal that the rate of digital banking adoption is likely to increase with the increase in the income of the respondents.

4.2. Determinants of adoption of digital banking

The adoption of digital technologies in banking has increased exponentially in the recent decade across the world (Chong, 2013; Mukhopadhyay, 2021; Shaikh & Karjaluo, 2015). Several studies have attempted to assess the factors affecting the adoption of digital banking services (Kalinić, Marinković, Kalinić, & Liébana-Cabanillas, 2021; Kaur et al., 2021; Rawashdeh, 2015). It is also evident that TAM is one of the most popular frameworks for assessing banking technology adoption (Carranza, Díaz, Sánchez-Camacho, & Martín-Consuegra, 2021; Patel &

Patel, 2018; Riffai, Grant, & Edgar, 2012; Sharma, Govindaluri, Muharrami, & Tarhini, 2017). Table 3 provides the results of the marginal effect of digital banking adoption in Saudi Arabia based on the extended Technology Acceptance Model (TAM). The impact of all three components of TAM i.e. perceived ease of use (PEOU), perceived usefulness (PU), and trust, has been estimated and controlled with the help of demographic variables such as gender, age, employment, education, and income for enhancing the robustness of the regression model. The goodness-of-fit of the regression model has been assessed with the help of coefficient, LR chi2, and pseudo-R2 statistics. Overall, the regression model seems to be reasonably strong.

The regression analysis results indicate a positive and significant impact of perceived ease of use ($\beta = 2.647; p < 0.01$) on the adoption of digital banking in Saudi Arabia. The positive and significant marginal effect reveals that perceived ease of use (PEOU) is 44.9% more likely to influence the adoption of digital banking service. Therefore, hypothesis H2, which assumed that perceived ease of use (PEOU) positively affects the customers' adoption of digital banking is accepted. Further, the impact of perceived usefulness (PU) on the adoption of digital banking in the Kingdom of Saudi Arabia is also positive and significant ($\beta = 0.687; p < 0.01$). The marginal effect depicts that those customers who perceive digital banking services to be useful are 11.6% more likely to adopt digital banking. Thus, hypothesis H3, which assumed that perceived usefulness (PU) positively affects the customers' adoption of digital banking is accepted. Finally, trust in digital banking technology has also been found to have a negative and significant effect on the adoption of digital banking in Saudi Arabia ($\beta = -0.318; p < 0.10$). The marginal effect indicates that customers having trust in digital banking services are 5.4% less likely to adopt digital banking. Therefore, hypothesis H4, which assumed that trust has a positive effect on customers' adoption of digital banking, is accepted.

Demographic characteristics of the respondents have been used as control variables to enhance the robustness of the regression estimates. As far as the demographic factors are concerned, gender, education and income were found to have no significant influence on the adoption of digital banking, whereas age ($\beta = 0.361; p < 0.01$), and employment ($\beta = 1.031; p < 0.05$) were found to be having a significant impact on the adoption of digital banking. Age and employment were found to have a positive marginal effect on the adoption of digital banking, implying that older respondents with a working status are more likely to adopt digital banking.

Table 3
Determinants of adoption of digital banking.

| Variables | Adoption of Digital Banking (1 Yes, 0 Otherwise) | | | |
|------------------------------|--|---------|------------------|---------|
| | β | P-Value | Marginal Effects | P-Value |
| Explanatory variables | | | | |
| Perceived Ease of Use (PEOU) | 2.647*** | 0.000 | 0.449*** | 0.000 |
| Perceived Usefulness (PU) | 0.687*** | 0.000 | 0.116*** | 0.000 |
| Trust | -0.318* | 0.085 | -0.054* | 0.083 |
| Control Variables | | | | |
| Gender | -0.091 | 0.606 | -0.015 | 0.606 |
| Age | 0.361** | 0.044 | 0.061** | 0.042 |
| Education | 0.266 | 0.222 | 0.045 | 0.221 |
| Employment | 1.031** | 0.002 | 0.175** | 0.002 |
| Income | -0.120 | 0.439 | -0.020 | 0.438 |
| Constant | -2.091*** | 0.000 | | |
| Number of obs | 1009 | | | |
| LR $\chi^2(8)$ | 367.960 | | | |
| Log likelihood | -514.931 | | | |
| Pseudo R ² | 0.263 | | | |

Source: Authors' calculations based on Global Financial Inclusion (GFI) Database 2017.

***significant at 0.01 level; **significant at 0.05 level; *significant at 0.10 level.

5. Discussions

Inclusion of technological innovation has transformed the banking sector throughout the world with the introduction of digital banking (Chauhan et al., 2022; Lichtenstein & Williamson, 2006; Tan et al., 2010) and the acceptance rate varies from country to country due to a host of factors (Takieddine & Sun, 2015). Several studies have been undertaken in recent years to assess the factors affecting the adoption of technological innovation in the banking sector (Kaur et al., 2021; Mukhopadhyay, 2021; Santos & dos Santos & Ponchio, 2021; Windasari et al., 2022). This study first attempted to assess the association between the adoption of digital banking and the demographic characteristics of the respondents in terms of gender, age, education level, occupation and income. The positive and significant association with demographic variables provides theoretical and practical implications. As far as the demographic variables are concerned, very few studies have tried to examine their effect on digital banking adoption. The association of demographic variables with digital banking adoption indicates that male individuals with 25–49 years of age, educated, working and having higher household income are comparatively more associated with digital banking adoption.

Further, this study uses an extended Technology Acceptance Model (TAM) to examine the factors that influence the adoption of digital banking. An extended version of the model is used for the study with an additional variable i.e., trust in digital banking technology. Demographic variables like gender, age, education, occupation, and income have been transformed and used as control variables in the study. This study has tried to identify the factors that significantly influence the adoption of digital banking in the Kingdom of Saudi Arabia. Analysis of marginal effect shows that age and employment significantly influence the adoption of digital banking technology in Saudi Arabia. Gender, education and income level were found to be insignificant. Gender and income have a negative influence on digital banking adoption, implying that females with lower income are more likely to adopt digital banking. Thus, the study corroborates with the findings of numerous other studies conducted worldwide that have established that perceived ease of use (PEOU), perceived usefulness (PU) and trust drive customers to adopt digital banking (Carranza et al., 2021; Mukhopadhyay, 2021; Roy, Balaji, Kesharwani, & Sekhon, 2017; Shaikh & Karjaluo, 2015).

5.1. Theoretical implications

This study assesses the determinants of digital banking adoption using the extended Technology Acceptance Model (TAM), which is a widely used technique for assessing technology adoption behaviour and attitude. Most of the earlier studies have used basic TAM with perceived ease of use (PEOU) and perceived usefulness (PU) as the major predated constructs in technology adoption. However, this study tried to include two additional dimensions in extending the Technology Acceptance Model (TAM). Firstly, digital banking in terms of making financial transactions, requires trust among the consumers besides perceived ease of use (PEOU) and perceived usefulness (PU). Therefore, an additional variable as trust in digital banking, has been incorporated into the regression model to estimate the marginal effect of trust on banking services. Secondly, the implications of demographic characteristics for digital banking adoption have been analysed in two ways – (i) association between demographic characteristics and adoption of digital banking, and (ii) demographics of the respondents as the control variable in enhancing the robustness of the regression model. With this extension of the research model, scholars and researchers would have a new horizon to explore in terms of predicting the adoption behaviour of consumers for digital banking services.

5.2. Practical implications

Practically, the outcomes of the present study have provided some

useful understandings pertaining to the adoption of digital banking in Saudi Arabia. This study provides implications for Saudi bankers, policymakers and other decision-makers for designing their digital banking strategies and policies, keeping in mind the factors that influence the digital banking adoption among Saudi customers. The study establishes the fact that Saudi customers will adopt the online banking technology if they feel that it is easier and more convenient to use as compared to traditional banking, in terms of saving time and being user-friendly; more useful to them as compared to traditional banking, in terms of number and relevance of services provided; and safe in terms of security in transactional processes. Saudi banks should therefore focus on simplifying the digital banking processes to make their functionality easier, thus making them more user-friendly. The services provided through digital banking should be increased to make it more useful for the customer to increase the adoption rate.

The negative and significant marginal effect of trust on the adoption of digital banking provides immediate practical insight to banking sector operators and regulators on ensuring security in digital transactions. Banks should focus on protecting the customer privacy and security in online transactional processes to establish the feeling of trust in the customers' minds. They should also provide regular information to the customers regarding their digital banking policies, various services offered, convenient features, and the security measure taken by them to protect the interests of the customers. Based on the analysis of the influence of demographic variables on digital banking adoption, banks should also try to target specific population segments that are more likely to adopt digital banking by designing segment-specific marketing programs for them. This will help the banks in increasing the adoption rate and customer satisfaction in the long run.

6. Conclusion, limitations and future research

The adoption of digital technology in the banking industry has transformed the financial landscape across the globe. The customers are increasingly becoming confident in doing online banking transactions through various digital platforms. This study evaluated the determinants of digital banking adoption among customers using extended TAM. Firstly, the study attempted to analyse the association between the demographic characteristics of respondents and digital banking adoption. All demographic variables such as gender, age, education level, occupation and income showed significant association with digital banking adoption. Secondly, the marginal effect through logistics regression has been estimated to identify the determinants of digital banking adoption. The empirical findings of this study support the theoretical model that embraces TAM with trust as an additional variable and age and education as control variables. Both the components of TAM i.e. perceived ease of use (PEOU) and perceived usefulness (PU) along with trust, showed a significant marginal effect on the adoption of digital banking in Saudi Arabia. Trust in banking has emerged as an important factor influencing the adoption of digital banking, which the banking institutions and regulators may take up for strengthening the security and privacy of the customers.

This study is based on data from a global survey of the World Bank, and the responses of the surveyed respondents have been recorded in discrete form, which provides limited opportunity to apply any sophisticated analysis technique. This study is also limited to the inclusion of only trust and demographic variables in the Technology Acceptance Model. More variables can be added to the model to test their influence on digital banking adoption in Saudi Arabia, such as psychological, cultural and religious factors. Therefore, there is ample opportunity to undertake a comprehensive primary survey using a scale-based structured instrument, which would allow to apply sophisticated techniques such as Structural Equation Modelling with extended use of the Technology Acceptance Model (TAM). This study is based on cross-sectional data, which captured the insight of a given time period. Therefore, there is a need to conduct an in-depth longitudinal study to assess the trends in

the adoption of changing digital technologies in the banking sector.

Declaration of Competing Interest

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

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