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Article

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Cardless Banking System in Malaysia: An Extended TAM

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Abstract: The main objective of this study is to analyse consumers' behavioural intentions to use cardless banking technology in Malaysia. The intentions to use this technology are evaluated through an extended Technology Acceptance Model (TAM) framework. The data were collected from 447 Maybank and Hong Leong Bank customers in Selangor and Kuala Lumpur. The results show that self-efficacy (SE) had a positive impact on the perceived ease of use (PEOU), while perceived risk (PR) had a negative impact on perceived usefulness (PU) and intention to use (IU) cardless banking. Next, the perceived ease of use (PEOU) had a positive impact on perceived usefulness (PU). The results further support the idea that perceived usefulness (PU) and perceived ease of use (PEOU) had the strongest impacts on intention to use (IU). The practical implications of this study suggest that developers of cardless banking technology should introduce secure, less complicated, and easily accessible technology to improve consumers' intentions to use. The perceived usefulness of this technology can be improved through promotional strategies and consumer training. Theoretically, this study has successfully extended TAM in the context of cardless banking technology in Malaysia. Moreover, this study will assist bankers in designing effective marketing strategies to attract more customers, which will add significant value to the overall business of the banking industry.

Keywords: cardless banking; fraud protection; customer intention; TAM; Malaysia



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1. Introduction

Over the past decade, cardless banking (CB) has emerged as an important tool in the reduction of financial crime and the protection of consumers' sensitive information leakage to identity thefts. Generally, financial crime is described as financial loss through unlawful activities such as fraud, tax evasion, and money laundering (Ofori-Dwumfuo and Gyimah 2013). During the last 40 years, financial crime, also described as a white-collar crime, has become an issue of global, governmental, and industrial concern. Moreover, it is defined as a nonviolent offence committed by or against an individual or corporation resulting in financial loss (Frunza 2016; Reuters 2018). In Malaysia, financial crime refers to cases involving cheque cloning, Automated Teller Machines (ATM) and credit card fraud, "Fly by Night" scams, Internet fraud such as spoofing, love scams, parcel scams, email hacking as well, as money laundering (PWC 2018). Malaysians lost nearly RM1.3 billion due to financial crime from January to August 2017. The Commercial Crime Investigation Department (CCID) of Malaysia investigated 26,548 cases of financial crime and reported a 42% increase in the year 2017 (PWC 2018). Although banks are considered the most protected and secure institutions providing security to their customers against financial crime, bank customers are still unable to avoid monetary loss.

The monetary loss suffered by customers was found to seriously damage banks' reputations and to negatively affect customer loyalty and shareholders' confidence (Lim et al. 2017). Banks continuously strive to discover efficient methods to provide financial security and convenience to their customers by developing and upgrading their services. CB is

a service provided by banks to protect their customers from falling prey to card fraud (Lim et al. 2017). Furthermore, CB enables customers to virtually access, withdraw, and manage their funds. Today's customers live in a stressful and globalised society and expect banks to provide innovative methods of accessing and managing their funds. Even though the usage of digital and card payment channels is continuously rising, there are times when cash is still needed as it is a widely preferred and accepted medium of exchange for goods and services. Based on these expectations, many global banks have introduced CB as a means to provide convenience and security to their customers.

CB falls under the category of mobile banking technology, which includes initiating a transaction through mobile phone devices and accessing and managing funds through authentication codes. Despite this, there are key differences in these technologies. For instance, CB users are required to provide physical proof of identity through audio, video, and biometric scanning to authenticate, access, and withdraw funds unlike mobile banking (Pons and Polak 2008). Furthermore, while mobile banking codes are only valid for short intervals, CB banking codes are valid for longer durations, which allow customers to conveniently withdraw cash at the nearest Automated Teller Machine (ATM) (Valentine 2014). CB is more secure compared to mobile banking as it requires dual authentication codes for the transaction (Istrate 2014) and the amount of cash withdrawn is limited compared to mobile banking, which allows users to transfer and pay lower amounts.

The commercial use of CB on a global scale was started by Webster Bank in the United States through biometric technology in the form of fingerprint authentication. Webster bank customers used Apple's touch identification to login and check their balance and transaction history or to initiate cash withdrawal without a bank card (Banking Technology 2015). Because of its convenience and security features as well as its potential influence to minimise financial crime, it gained huge popularity in the banking industry (FIS 2015). The attractive benefits and security features also drew in a growing number of consumers who have already adopted or are planning to adopt this technology. Furthermore, the increase in customers' interest in adopting this technology generates revenue for banks and allows them to enhance the range of their products and services.

CB technology in general and the CB system in particular are both developing at a rapid pace; this has created uncertainty among consumers. Because of the associated risks and the lack of knowledge of the benefits of CB, consumers hesitate to use this technology as the perceived risks may be overwhelming compared to the traditional method of banking. Additionally, CB is viewed as a form of complicated technology, where consumers' judgements about the capabilities (such as required knowledge, skill, and self-efficacy) to use the technology may impact their intentions. According to the Global Mobile Banking Report (KPMG 2015), the mobile banking adoption rate has increased by 43% and it was projected that, by 2019, there will be 1.8 billion mobile banking users. Bank Negara Malaysia's (BNM) recent statistics also show that mobile banking has a penetration rate of 42.8%, which is an optimistic indication for CB banking developers of the increase in consumer intentions to adopt the technology (BNM 2018). Although previous studies have analysed Internet and mobile banking adoption in Malaysia (Mansour 2016; Nor and Pearson 2009; Poon 2008; Low et al. 2017; Hanudin et al. 2007; Amin et al. 2012; Tan et al. 2010), there has been little or no research analysing the intentions to use CB, especially in the context of Malaysia.

Based on the preceding discussion, the present study aims to develop and test a comprehensive conceptual framework to analyse the acceptance of a CB system in Malaysia. To achieve the objective of this study, the Technology Acceptance Model (TAM) is used to test and propose the extended framework (Davis 1989). The proposed model contains two additional constructs of perceived self-efficacy and perceived risk in addition to perceived ease of use and perceived usefulness. Furthermore, the present study aims to analyse the impact of self-efficacy on perceived usefulness and perceived ease of use as well as the impact of perceived risk on perceived usefulness and intention to use. Finally, this study focuses on analysing the relationship between perceived usefulness, perceived ease of use,

and behavioural intentions to use CB technology. The remaining paper proceeds as follows: Section 2 outlines the literature review and conceptual framework adopted in this study. Section 3 discusses the methodology. Section 4 presents the findings and analysis, and lastly, Section 5 presents the discussion, conclusion, and implications of this study.

2. Literature Review

2.1. Cardless Banking (CB)

CB is described as the withdrawal and/or transfer of funds by banked, underbanked, or unbanked consumers using Automated Teller Machines (ATMs) through a wireless network (Karthikeyan 2012). For the purpose of this study, CB refers to consumers' virtual access to the funds and facilities provided by banks without using a bank card. This type of banking is a major breakthrough in the banking industry in relation to the fight against financial crime as consumers are not required to carry their bank cards to withdraw, access, and transfer funds (FIS 2015). CB protects consumers against card fraud, skimming, and counterfeiting, which usually takes place while swapping or inserting the card into an ATM or point of sale (POS) terminal during the purchase of goods and services (Budhram 2012). The ATM marketplace research shows that more than 31.8 million consumers have had their card compromised, losing \$1 billion in 2014 (NASDAQ 2015).

2.2. Factors Influencing the Acceptance of CB

A detailed review of the literature shows that several factors may impact the acceptance of CB systems. The identified factors include financial risk, consumers' knowledge, and perceived usefulness, which includes ease of use and convenience. The impact of these factors is briefly discussed below.

2.2.1. Financial Risk

Financial risk refers to the possibility of monetary loss due to an error in transactions as well as card fraud through skimming and counterfeiting (Lee 2008). Card fraud in conventional banking is one of the leading factors of loss of money due to unauthorized card access (Kabir 2013). Financial risk represents consumers' unwillingness to trust certain technologies due to fear of monetary loss (Ricciardi 2008). The perception of financial risk is a subjective norm as certain actions that are perceived as a major risk by some individuals may not be a potential threat to others (Ricciardi 2008). Due to fear of monetary loss, customers expect banks to retain confidentiality of their personal information. Consumers in the banking industry hesitate to reveal their personal information, account details, and credit card numbers. Thus, CB may broadly be accepted by customers, provided that banks are able to assure that any personal information will not be revealed to any unauthorized parties (Aliyu 2012). Feelings of financial insecurity or anxiety before, after, or during the CB usage significantly affect consumer perceptions, which have a direct impact on the acceptance of this technology (Halaweh 2012). Consumers are likely to resist CB acceptance if the nature of transactions is perceived to be risky (Lee 2008). As a result, CB technology could be widely accepted and adopted, provided that consumers perceive it to be less risky and financially secure (Kesharwani and Bisht 2012).

2.2.2. Knowledge

Knowledge in this context is described as the consumer's familiarity with the existence of certain innovations and the ability to understand the associated benefits of using said innovation (Al-Fahim 2012). Juwaheer et al. (2013) defined knowledge as the consumer's information and understanding level about a certain product and service. Knowledge is a set of facts and ideas which enable the consumer to develop an appropriate judgement or perception. Information technology plays a key role in developing a positive judgement or perception, as consumers' perceptions and judgements are influenced through information sharing with other people (Woodward 2000). Hence, it can be assumed that sufficient knowledge about CB and its benefits will initiate its adoption process. Consumers' pleasant

experiences during transactions will create positive feedback and positive judgements towards the perception of CB. Furthermore, consumers are expected to continue using CB provided they have a positive perception of its associated benefits (Al-Fahim 2012).

2.2.3. Perceived Usefulness

Perceived usefulness refers to the ability of a product, service, or innovation to improve consumers' performance or satisfaction (Al-Fahim 2012). Consumers perceive CB to be more useful if it is integrated into their daily life and has the potential to bring comfort in daily life activities (Rono 2014). CB has the potential to improve consumers' expectations and perceptions towards its technology through four aspects. These aspects include the duration of completing tasks, the increase in productivity and efficiency, required knowledge and skill, and facilitation provided to the consumers (Khayati and Zouaoui 2013). Consumers will perceive CB as useful if it provides a solution to their problems (Karake et al. 2019) such as protection of their information and overcoming card fraud (Hsu and Chang 2013). At the same time, the technology will be perceived as useful if it is found to improve productivity, to enhance the speed at which tasks are completed, as well as to facilitate normal banking operations. An improved perception towards the usefulness of CB signifies better acceptance of this technology. Hence, it is inferred that consumers are more likely to accept and continue CB, provided that they have positive perceptions of the usefulness of this technology (Al-Fahim 2012).

2.2.4. Ease of Use

Ease of use refers to consumers' abilities to operate and/or use a system or item with cognitive skills and knowledge (Bevan et al. 1991). Less complicated, user-friendly, and easily adoptable technologies are perceived to be easy to use and adopt (Karake et al. 2019). Ease of use helps banks to bridge a relationship with their consumers (Jeong and Yoon 2013). If banks render less complicated services, it will create a positive image for the bank as service customisation enables a customer-focused approach (Jeong and Yoon 2013). Consumers' may find CB complicated and difficult to use if it is less efficient and contains technical difficulties. If less technically complicated methods and ease of use are positively perceived by consumers, their acceptance rate may be enhanced (Kesharwani and Bisht 2012).

2.2.5. Convenience

Convenience is defined as "the time and effort saved in performing a task" (Chang et al. 2012; Cheney 2008). It is also referred to as the quality of technology suitable for an individual's comfort, intentions, and needs (Clemes et al. 2012). Convenience comprises five dimensions: time, place, acquisition, use, and execution of technology (Bhatiasevi 2015). Time and place refer to when and where CB can be used (Bhatiasevi 2015). The acquisition and use dimensions measure the ease of using and acquiring CB and the convenience experienced by users. Execution measures the effectiveness of CB service provided to the consumers. Cheney (2008) found that highly convenient CB services enhance the intentions of consumers to accept and continue using the technology.

2.3. Theoretical Framework and Research Model

This study adopted the Technology Acceptance Model (TAM) (Davis 1989) to identify the factors that may affect customers' acceptance of CB in Malaysia. Davis (1989) identified different variables through this model that impact users' perceptions to accept or reject technology. Among these variables were two theoretical constructs known as "perceived usefulness" and "perceived ease of use" which play important roles in the overall acceptance or rejection of a technology (Davis 1989). People tend to use or not use a form of technology based on the extent to which it will help them perform their job. Davis (1989), however, found that people may still reject the use of a complicated form of technology despite its known usefulness or "perceived ease of use".

The extensive literature on information technology shows that numerous studies have adopted TAM to predict consumers' intentions to use innovation (Kim and Qu 2014). Furthermore, many studies used an extended version of TAM which links different constructs such as compatibility (Kim and Qu 2014), self-efficacy (Ozturk 2016), trust, and perceived risk (Kesharwani and Bisht 2012) and perceived security (Hossain and Prybutok 2008).

TAM was originally developed to analyse employees' acceptance of technology within an organisation. Later, many studies deployed TAM to investigate and explain the adoption of mobile wallets (Chopra 2019; Saxena 2018; Leon 2018; Sobti 2019). Due to the construct flexibility of TAM, it can also be integrated into diverse non-organisational settings (Thiesse 2007). However, in the case of CB, the available construct of TAM is insufficient to investigate users' acceptance of this technology as users' cognitive differences and the actual purpose of use may mediate the overall acceptance rate. Hence, this study suggests using an extended TAM model to investigate all the possible factors which may impact the acceptance of CB technology. The present study uses an extended TAM model with two additional constructs, namely self-efficacy and perceived risk (Figure 1).

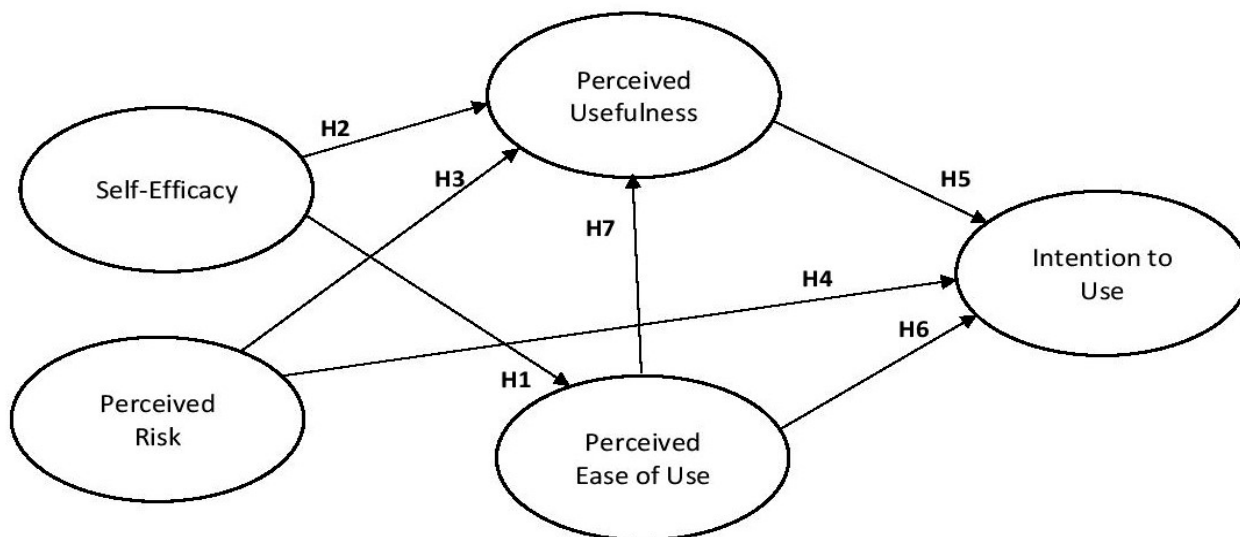


Figure 1. Conceptual framework and hypotheses.

2.3.1. Self-Efficacy, Perceived Ease of Use, and Perceived Usefulness.

Bandura's (1986) social cognitive theory includes a key concept of self-efficacy which is defined as "individuals' judgement of self-capabilities to perform a range of actions to execute a given task". Instead of testing individuals' skill levels, it focuses on individuals' judgement of their capabilities to execute a task. Bandura also states that self-efficacy affects the adopted behaviour, time, and the amount of effort given to the task as well as the time given to learn the operational difficulties in the execution of a task. According to Luarn and Lin (2005), self-efficacy is a significant factor to measure knowledge, skill, and ability to use a certain technology.

This study defines perceived self-efficacy as the judgement of consumers' abilities to use CB technology. Igarria and Iivari (1995) found that self-efficacy has an effect on consumers' anxiety, which directly affects the perceived ease of use and perceived usefulness. Studies on the adoption of mobile banking have found a significant direct relationship between self-efficacy, perceived usefulness, and perceived ease of use (Singh and Srivastava 2020; Mutahar et al. 2018). Chong et al. (2012) found that confidence in one's ability shapes the perceptions of how to use a certain technology.

Based on the preceding evidence of a strong relationship between self-efficacy, perceived ease of use, and perceived usefulness, this study proposes the following hypotheses:

Hypotheses 1 (H1). *There is a positive relationship between self-efficacy and perceived ease of using CB.*

Hypotheses 2 (H2). *There is a positive relationship between self-efficacy and perceived usefulness of CB.*

2.3.2. Perceived Risk, Perceived Usefulness, and Intention to Use

Lim (2003) found that the theory of perceived risk refers to consumers' perception of risk as a result of experiences with uncertain and undesirable consequences during purchases. Bauer (1960) defined risk as "any action of consumers involv[ing] a risk that produces uncertain and unpleasant outcomes". Previous studies on electronic commerce, self-service technologies, mobile commerce, and mobile banking found that perceived risk directly impacts the acceptance of technology (Lim 2003; Kim and Qu 2014; Chen 2013; Zhang et al. 2018; Singh and Srivastava 2020). There are certain risks involved in using all technologies, and CB is no exception as it also relies on the availability of an Internet connection and the use of authentication codes. Internet availability and the speed of receiving authentication for CB transactions may deteriorate and thus may affect the intention to use. Given this assumption, the following hypotheses investigate the relationship between perceived risk, perceived usefulness, and intention to use CB:

Hypotheses 3 (H3). *There is a negative relationship between perceived risk and perceived usefulness of CB.*

Hypotheses 4 (H4). *There is a negative relationship between perceived risk and intention to use CB.*

2.3.3. Perceived Ease of Use, Perceived Usefulness, and Intention to Use

Consumers' intentions to continue using technology is affected by perceived ease of use and perceived usefulness (Davis 1989). Several empirical studies on information technology acceptance suggest the existence of a direct relationship between these constructs (Kucukusta et al. 2015; Hernandez et al. 2009; Raza et al. 2017). This study defines perceived usefulness as the extent to which CB assists consumers in providing convenience and protection from card fraud via skimming and counterfeiting. Previous studies on acceptance and continuation of electronic banking have confirmed that a confirmation of expectations ensures continued use of certain services (Cheng 2013; Mirkovski et al. 2018; Ogedengbe and Talib 2020). This study investigates the impact of perceived ease of use and perceived usefulness on the intention to use CB through the following hypotheses:

Hypotheses 5 (H5). *There is a significant positive relationship between perceived usefulness and intention to use CB.*

Hypotheses 6 (H6). *There is a positive relationship between perceived ease of use and intention to use CB.*

Hypotheses 7 (H7). *There is a significant relationship between perceived ease of use and perceived usefulness of CB.*

3. Methodology

The data for this study were collected from 20 February 2019 to 20 March 2019 through a self-administrated questionnaire from 447 CB users in 5 branches located in Kuala Lumpur and Selangor states of Malaysia. The non-random convenience sampling technique was adopted for data collection. The sampling population was comprised of Maybank and Hong Leong bank customers who heard of or have used CB in the past. The reason we limit population sampling on these customers is due to the expectation that they have substantial experience and knowledge of using CB since Maybank and Hong Leong Bank are the pioneers of CB in Malaysia. Because of this, the customers from these banks

were considered appropriate respondents for this study. These walk-in customers were approached politely and were asked if they were willing to participate in the survey. A brief background of CB and the purpose of the survey was provided in the introduction of each questionnaire.

The survey questionnaire was divided into two sections: section A contained demographics of the respondents, and section B comprised of 22 sub-items. These items were adopted from a slight modification of TAM. This study specially adopted TAM as it was widely put into use by the scholars in the past to predict and foresee individuals' behaviour in the acceptance of technology (Davis 1989; Dishaw and Strong 1999; Carey and Day 2005). Perceived ease of use (PEOU) and perceived usefulness (PU) were measured by four items and were adopted from Davis (1989). Self-efficacy (SE) was measured by five items adopted from Compeau and Higgins (1995), while perceived risk (PR) was measured using 4 items adopted from Im et al. (2008). Finally, behavioural intention to use (IU) was measured using 5 items adopted from Davis et al. (1992). Respondents were then required to answer a question using a five-point Likert scale that ranged from strongly disagree (1) to strongly agree (5).

A total of 470 questionnaires were circulated; however, only 457 were returned by respondents, which shows a return rate of 97.23%. For data analysis, 447 questionnaires were considered suitable to use as the remaining 10 were found incompletely responded. To test this proposed model, a two-step approach was adopted based on a previous study of Fornell and Larcker (1981). The model was tested through a principal component analysis (PCA) and structural equation model (SEM) analysis.

4. Results

4.1. Respondents' Profiles

The descriptive statistics of the respondents are presented in Table 1. About 44.07% of respondents were male, and 55.92% were female. The majority of the respondents were aged between 31–40 (46.97%) and 26–30 (28.41%); 48.54% of respondents held a bachelor's degree, while 48.54% were employed in the government sector. About 44.29% of respondents' income ranged between RM3001 to 5000 per month, and 91.94% had used CB in the past.

Table 1. Respondents' demographic statistics.

Demographic Characteristics	N	%
Gender		
Male	197	44.1
Female	250	55.9
Total	447	100
Age		
18–25	31	6.93
26–30	127	28.4
31–40	210	47
41–50	47	10.5
Above 50	32	7.15
Education		
High School	38	8.5
Diploma	120	26.8
Bachelor Degree	217	48.5
Master Degree	63	14.1
Doctorate Degree	9	2.01

Table 1. *Cont.*

Demographic Characteristics	N	%
Occupation		
Student	33	7.38
Government	168	37.6
Private	137	30.6
Self-employed	109	24.4
Income (RM)		
Below 1500	17	3.8
1501–3000	154	34.5
3001–5000	198	44.3
5001–10,000	46	10.3
Above 10,000	32	7.15
Past Experience		
Yes	157	35.1
No	290	64.9

4.2. Correlation Analysis

The correlation between independent variables was analysed through the Pearson correlation test. The test is useful in detecting multicollinearity issues in the model. The proposed model suffers from multicollinearity issues if variables are correlated at equal to or greater than 0.80.

The correlation matrix test results presented in Table 2 indicate that the proposed model does not contain multicollinearity issues as a weak correlation exists between all independent variables.

Table 2. Correlation coefficients.

Independent Variables	PEOU	PU	SE	PR
PEOU	1.00			
PU	0.42	1.00		
SE	0.12	0.14	1.00	
PR	0.32	0.36	0.19	1.00

4.3. Reliability Analysis

The consistency between the two measures represents the reliability of the measuring instrument (Nunnally 1978). Reliability is measured by an alpha (α) value known as Cronbach's alpha. The measurement instrument is considered reliable provided that Cronbach's alpha value is greater than the threshold value of 0.60 (Hair et al. 1998). The test results presented in Table 3 indicate that our measurement instrument is reliable, as the Cronbach's alpha values for all items are greater than the minimum criteria of 0.60.

Table 3. Cronbach's alpha test results.

Variables	N	Cronbach's Alpha
Self-efficacy	5	0.744
Perceived usefulness	4	0.736
Perceived Ease of Use	4	0.728
Perceived risk	4	0.817
Intention to use	5	0.860

4.4. Kaiser–Meyer–Olkin and Bartlett's Tests of Sampling Adequacy

Kaiser–Meyer–Olkin (KMO) and Bartlett's test were used to analyse the sampling adequacy in this research. The test results are presented in Table 4 below.

Table 4. Kaiser–Meyer–Olkin (KMO) and Bartlett’s test results.

KMO Measure of Sampling Adequacy and Bartlett’s Test of Sphericity	0.817
Approximately chi-square	512.681
Df	194
Probability	0.000

KMO for all the items is 0.817, which is 81.70%. This indicates that the sampling adequacy is satisfactory as the KMO value is higher than the minimum criteria of 0.50, which is 50% (Leech et al. 2005). Bartlett’s test of sphericity is used to confirm the significant differences in the properties of the correlation matrix and the identity matrix. The literature suggests that the probability value should be less than 0.05 to represent the significant differences in the properties of the correlation matrix and identity matrix (Leech et al. 2005). The values of Bartlett’s test of sphericity presented in Table 4 indicate significance at the 1% level, which implies that the sample data of this study is suitable for factor analysis (Bartlett 1954).

4.5. Total Variance Explained

The variance partition among potential variables can be clarified through total variance explanation. The usefulness of factors can be determined by the general criteria of Eigenvalues, which must be greater than 1 for all factors. The Eigenvalues presented in Table 5 are greater than 1.0, which confirms the usefulness of our factors. The cumulative variance explained by all five factors is 70%, which is considered very good and significant.

Table 5. Results of variance explained.

Items	SE	PR	PEOU	PU	IU
Variance explained by each factor in percentage	18	17	20	12	7
Cumulative variance explained in percentage	30	43	56	62	73

Extraction method: principal components analysis.

The correlation between the questionnaire statements is estimated by Principal Component Analysis (PCA). The findings of PCA are presented in Table 6. the factor loading for each item is higher than the acceptance criteria of 0.70 (Table 6). Additionally, the respondents have a fair understanding of most of the statements as the mean values for each construct (SE, PU, PEOU, PR, and IU) are greater than 3.0. The standard deviation results further confirm that the variance in the response for each construct is low as the values of standard deviation values were below 1.

Table 6. Results of varimax rotation (factor loadings of observable variables).

Observable Variables	Factor Loadings	Communality	Mean	SD
Self-Efficacy (SE)	0.765	0.710	3.113	0.8232
SE1) I feel confident using CB to access my account.	0.797	0.712	3.432	0.8001
SE2) I feel confident using CB to review my transaction history.	0.812	0.734	3.876	0.9836
SE3) I feel confident using CB for many other transactions.	0.789	0.580	4.234	0.8950
SE4) I am confident to use CB if someone shows me how to use it	0.746	0.600	4.098	0.8510
SE5) I am confident to do CB transactions if there is built-in assistance.	0.749	0.673	3.893	0.8434
Mean 3.750; SD 0.8705				

Table 6. Cont.

Observable Variables	Factor Loadings	Communality	Mean	SD
Perceived Usefulness (PU)				
PU1) The use of CB will help me in making a quick transaction.	0.823	0.750	5.242	1.6432
PU2) The use of CB makes the execution of a transaction very easy.	0.850	0.740	5.813	0.9567
PU3) The use of CB is beneficial for me.	0.843	0.709	5.421	0.8034
PU4) CB provides greater control over financial transactions.	0.811	0.769	5.222	0.9456
Mean 5.271; SD 1.0446				
Perceived Ease of Use (PEOU)				
PEOU1) CB is more user-friendly than using an ATM card.	0.745	0.542	4.661	0.8745
PEOU2) CB has a clear and easily understandable system of interaction.	0.841	0.712	2.456	0.9856
PEOU3) CB has the flexibility of interaction.	0.814	0.787	3.639	0.9302
PEOU4) CB makes it easy to do transactions.	0.764	0.707	3.209	0.8903
Mean 3.498; SD 0.8646				
Perceived Risk (PR)				
PR1) I may lose money because of CB if my information is stolen.	0.799	0.717	4.845	0.7432
PR2) My personal data may leak by using CB.	0.712	0.789	3.345	0.7739
PR3) I will waste too much time while learning how to use CB.	0.7387	0.681	3.579	0.6834
PR4) Using CB makes me feel nervous.	0.629	0.730	3.284	0.6725
Mean 3.284; SD 0.8201				
Intention to use (IU)				
IU1) I would use other CB services for my banking needs.	0.759	0.740	3.750	1.3857
IU2) I often use CB to transfer money in addition to withdraw cash.	0.731	0.712	4.305	0.8404
IU3) I see myself using other CB services for handling my banking transactions for many years to come.	0.750	0.730	4.110	0.8402
IU4) I often use CB to check my account balance.	0.795	0.760	4.509	0.9595
IU5) I intend to consult the bank personal about additional platforms to use CB.	0.701	0.730	4.802	0.9645
Mean 4.2952; SD 0.9980				

4.6. Model's Goodness-of-Fit Analysis

The goodness-of-fit measures were used to evaluate the structural model. The structural equation model (SEM) approach analyses how well the model fits the data set. Simultaneously, the objective of the structural model was to test whether the intention to use CB is a multidimensional construct comprising of five sub-variables. The results of the goodness-of-fit of the measurement model for this study are presented in Table 7. It is clear from the results that the measurement model is a statistically good fit as the RMSEA (root mean square error of estimation), PCLOSE (close fitting model, p must be higher than 0.05 for the structural model for an acceptable model fitness), CFI (comparative fit index), and TLI (Tucker-Lewis index) values meet their threshold levels. Furthermore, the results show that 22 indicators of the PCA model of intentions to use CB were fit to the sample data.

Table 7. Model fit test results.

Goodness-of-Fit Measures	CFI	TLI	RMSEA	PCLOSE
Cut-off values Close to	≥ 0.97	Close to 1	≤ 0.04	> 0.04
Measurement model	0.910	0.912	0.03	0.368
Structural model	0.983	0.985	0.001	0.992

Note: Measurement model $1/4$ 21 items; structural model $1/4$ 21 items.

4.7. Hypothesis Testing

The standardized parameter estimates and the significant values for the hypothesised relationships are shown in Table 8. The findings suggest that SE has a positive influence on PEOU; therefore, H1 is supported. However, SE does not positively influence PU. Hence, H2 is not supported. PR has a negative impact on PU and IU, and therefore, H3 and H4 are also supported. PU and PEOU have a significant positive influence on IU, which shows that H5 and H6 are also supported. Similarly, PEOU also has a significant positive influence on PU, which shows that H7 is also accepted.

Table 8. Standardized regression weights for the model.

Structural Paths	Standardized Path Coefficients	T-Values	Hypothesis Supported Yes/No
H1: SE \rightarrow (+PEOU)	0.16	2.36 **	Yes
H2: SE \rightarrow (+PU)	0.04	0.26 n.s.	No
H3: PR \rightarrow (−PU)	−0.38	9.33 ***	Yes
H4: PR \rightarrow (−IU)	−0.36	5.09 ***	Yes
H5: PU \rightarrow (+IU)	0.45	7.30 ***	Yes
H6: PEOU \rightarrow (+IU)	0.43	5.9 ***	Yes
H7: PEOU \rightarrow (+PU)	0.41	8.30 ***	Yes

** $p < 0.05$; *** $p < 0.001$; n.s., nonsignificant.

Overall, the results show that all hypotheses of this study were supported except H2. Specifically, it is found that self-efficacy has a positive impact on perceived ease of use while perceived risk has a negative influence on perceived usefulness and intention to use. Additionally, perceived usefulness and perceived ease of use were found to have the strongest positive influence on intention to use. Lastly, perceived ease of use has a significant positive impact on perceived usefulness.

5. Discussion and Conclusions

The purpose of this study was to propose and test a theoretical model to analyse consumers' behavioural intentions to use the cardless banking system in Malaysia. The study used an extended version of TAM to empirically examine the relationship between two exogenous variables (self-efficacy and perceived risk) and three endogenous variables (perceived usefulness, perceived ease of use, and behavioural intention).

The findings of this study indicate that self-efficacy has a positive impact on perceived ease of use (H1-path coefficient = 0.16). This finding is consistent with prior studies (Singh and Srivastava 2020; Mutahar et al. 2018; Ozturk 2016) which confirm that consumers with a higher level of self-efficacy are more likely to use cashless payment technologies. On the other hand, findings related to H2 (path coefficient = 0.04) reveal that self-efficacy does not positively impact perceived usefulness. The findings for H3 (path coefficient = −0.38) and H4 (path coefficient = −0.36) confirm that perceived risk has a negative impact on perceived usefulness and intention to use. Overall, these results are parallel with the findings of prior studies such as Zhu et al. (2012), Ozturk (2016), and Chawla and Joshi (2020), which support the idea that perceived risk has a negative influence on perceived usefulness and intention to use cashless payment technology.

Alternatively, the findings further indicate that perceived usefulness (H5-path coefficient = 0.45) and perceived ease of use (H6-path coefficient = 0.43) have the strongest impacts on intention to use. These results are compatible with previous studies (Kucukusta et al. 2015; Ozturk 2016; Lai 2017; Singh and Srivastava 2020; Ramesh et al. 2020; Ananda et al. 2020) which found that perceived usefulness and perceived ease of use are the major factors in determining behavioural intention towards technology adoption. Lastly, the study supported H7 (path coefficient = 0.41), which proved that perceived ease of use significantly influences perceived usefulness. This result is consistent with Shaw and Kesharwani (2019), who suggested that less complicated technology is perceived to be more useful by users.

This study contributes to authenticating TAM to develop a measurement model analysing customers' intentions to use the CB system in Malaysia. Academicians and scholars may adopt a similar measurement model to analyse behavioural intentions for information technology services. Lastly, this study will assist bankers' in planning and promoting CB by enhancing its adoption.

5.1. Theoretical Implications

This study has significantly contributed to the general body of knowledge in the context of technology acceptance, particularly CB technology acceptance in Malaysia, a country where many studies have already analysed the acceptance of Internet and mobile banking technology. In terms of theoretical constructs, the current study is the frontier offering detailed insight into the acceptance of CB technology in Malaysia.

The second theoretical contribution of this study is towards the validation of TAM in the context of CB technology acceptance. This study has analysed the acceptance of technology from a customer perspective as compared to past studies which have used TAM to examine technology acceptance in the context of work-related activities of employees.

Finally, the third most significant contribution of this study is the extension of TAM. This research has successfully extended TAM through two additional constructs which are useful in analysing the acceptance of CB technology under the given settings.

5.2. Practical Implications

The findings of this study provide several practical implications for policymakers in the banking industry who have already adopted, have yet to adopt, or have the intention to adopt CB technology in the future. These findings are valuable for virtual banking consultants as they help identify important factors in developing CB technology. Furthermore, it is suggested that perceived ease of use and perceived usefulness are the most significant factors for consumers' intentions to use this technology. As a result, CB technology developers should introduce secure, user-friendly, and easily accessible technology so that it is widely accepted by consumers. Additionally, to enhance users' levels of perceived usefulness, banking professionals and marketers should promote the potential advantages of CB to users by explaining to them the benefits of CB (such as protection of card fraud, card skimming, and card counterfeiting) as well as the convenience they will receive when using CB.

Next, the findings of self-efficacy reveal that users with a high level of self-efficacy are likely to have more ease while using this technology. Therefore, CB facility providers need to organise training sessions to enhance users' familiarity with this technology. These training sessions can be organised through brief physical and video demonstrations during roadshows, on TV, and/or on social media. Finally, banking industry operators need to develop effective marketing strategies to attract more customers which will add significant value to the overall business of the industry.

5.3. Limitations and Future Research

Like many other technology acceptance studies, this study also has a number of limitations. Firstly, it only measures consumers' intentions to use CB technology instead of

their actual behaviour. Even though a brief explanation of CB technology was provided in the survey questionnaire introduction, future studies may focus on measuring consumers' actual behaviour.

Secondly, the TAM model used in this study is extended by two additional constructs, whereas other factors such as privacy, security, trust, compatibility, cost, and satisfaction, which were not explored in this research, may also alter consumers' intentions. Hence, future studies may consider additional constructs to analyse consumers' intentions towards this technology.

Another limitation is associated with the data collected through the non-random convenience sampling technique, which may result in similar respondents' characteristics. This was the only effective data collection method as users of CB were unknown to the researchers due to banks' policies on the confidentiality of customers' information.

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