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FACTORS AFFECTING CUSTOMERS' ACCEPTANCE OF THE ADOPTION OF BLOCKCHAIN TECHNOLOGY AT DONG A COMMERCIAL JOINT STOCK BANK, HUE BRANCH

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Abstract: This study aims to develop and test the integrative model of the factors affecting customers' acceptance intention of the adoption of blockchain technology. Data were collected from a sample of 195 customers who have been conducting transactions at Dong A Bank – Hue branch. Samples are selected by using the systematic random sampling method. Structural equation modelling (SEM) is used to test the hypothesized relationships. The findings indicate that six out of eight tested relationships are supported. Perceived usefulness (PU) and Perceived ease of use (PEU) are the most critical factors affecting customers' Attitude (AT). Attitude also has a direct and positive correlation to customers' acceptance Intention (IN). Notably, Personal characteristics (PC) and Risk perception (RP) are the two most influential factors affecting Perceived usefulness. And, the Perceived ease of use factor is only affected by customers' Self-command (SC). In general, this study contributes to enriching the existing knowledge of blockchain adoption in banks and helps banks figure out an efficient way to adopt blockchain technology.

Keywords: customers' acceptance, blockchain adoption, Dong A Bank, Hue branch

1 Introduction

Blockchain's key properties of decentralization, immutability, efficiency, cost-effectiveness, and security are leading to growing support for the technology's adoption across the entire range of the banking system [13]. According to PricewaterhouseCoopers (PwC), 77 percent of financial institutions are expected to adopt blockchain technology as part of an in-production system or process by 2020 [15]. Regardless of the enormous benefits of blockchain, the adoption of this technology in banks is doubted by their customers. Lack of technology proficiency, status quo mindset, the credibility of blockchain, and regulatory complexity are common constraints for customers' acceptance [20].

In recent years, along with the increasing concerns of banks about blockchain, the topic of assessing factors affecting customers' acceptance of the adoption of blockchain technology has thus been recognized as a field of growing interest worldwide [22]. Much research has been implemented to build an efficient solution to integrate blockchain into the existing banking

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system in a user-friendly way [3, 13]. Some authors interest in clarifying the benefits and drawbacks to customers when blockchain is applied in banking transactions [12, 19]. Another group of researchers try to analyse the belief, attitude, intention, and behaviours of stakeholders in the supply chain of financial services on blockchain solutions [16, 18]. Despite the increase in the number of related works, there are still gaps in the knowledge base. Although some authors notice on the factors affecting customers' acceptance intention, these studies still have not reached a consensus on the quantitative model and scales to measure these factors [11]. Especially, in the case of blockchain, the new technology would create new unknown factors. Besides, blockchain issues in general and blockchain applications in banks are still a new topic in Vietnam. The researchers have not yet thoroughly tested the blockchain acceptance models in the practice of a bank or financial institution in general [11].

From a practical perspective, Dong A Bank, with the strategy of becoming a leading bank for applying new financial technology, is considering to deploy blockchain applications in the next 3 years.

From the above urgent problems with the case of Dong A Bank – Hue branch, this study was carried out with two main objectives:

- Identify and analyse the factors affecting customers' acceptance of the adoption of blockchain technology.
- Propose policy implications to help the bank figure out an efficient way to adopt blockchain technology.

2 Literature review

Blockchain is defined as a growing list of records, called blocks, that are linked by using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data [13]. For use as a distributed ledger, a blockchain is typically managed by a peer-to-peer network collectively adhering to a protocol for inter-node communication and validating new blocks. Once recorded, the data in any given block cannot be altered retroactively without the alteration of all subsequent blocks, which requires consensus of the network majority [23].

There are six most potential applications of blockchain in banks, including 1) **Fraud Reduction** – Most banking systems in the world, built on a centralized database, are more vulnerable to cyberattacks because once hackers attack one system, they get full access to it. Blockchain would eradicate some of the current crimes committed online today against our financial institutions [22]; 2) **Payments** – Blockchain would eradicate all the intermediaries in the payment processing system to build higher security with minimal costs to process payment [16]; 3) **Smart Contracts** – Blockchains facilitate smart contracts as computer code that can be executed

once two or more parties enter their keys. Contracts could be created, and financial transactions could be executed when this code is programmed according to the set criteria [12]; 4) **Know your Customer (KYC)** – Blockchains allow an organization to access the verification details of a client by another organization, thus avoiding repetition of the KYC process. The reduction in administrative costs for compliance departments would be significant [8]; 5) **Clearing and Settlement** – Banks could transfer post-trade clearing and settlement on to a blockchain system [17]; 6) **Trade Finance** – Blockchains could digitize the entire trade ecosystems. For instance, bills of lading or letters of credit are mostly based on paper and contain very important information of the supply chain that numerous parties need access [12].

Although blockchains bring numerous benefits to the banking system, there still exist constraints preventing the adoption of this technology in both macro aspects (such as requiring large investments in infrastructure, a need of a solid legal foundation, etc.) and micro aspects (such as the acceptance of stakeholders in the supply chain of banking services, their knowledge and ability to use new technology, etc.). Among them, customers' acceptance is the most important one [17]. Various characteristics have been identified, which appear to influence customers' acceptance of new technology, like blockchains. Among them are:

Relative advantage. This is the degree to which potential customers perceive the innovation as superior to existing substitutes. Some of the factors involved could include economic profitability, low initial costs, lower perceived risk, decrease in discomfort, savings in time and effort, and immediacy of reward factors. Relative advantage is positively related to the diffusion rate [6].

Compatibility. This is the degree to which potential consumers feel that innovation is consistent with their socio-cultural norms or is consistent with existing values, experiences, and needs. Previously introduced ideas will impact the adoption of any new technology. The rate of adoption is affected by the old idea it supersedes – the more compatible it is with the previous idea, the less of a change it is. Compatibility is positively related to the diffusion rate [15].

Complexity. The innovation is perceived as difficult to comprehend or use. Complexity is also related to the number of decisions required as well as the number of decisions that must be repeated. Complexity is highly negatively correlated with the rate of diffusion [8].

Trialability (*divisibility*). This is the degree to which a new product is capable of being tried or experimented on a limited basis by consumers. Trialability is a positively related trait to the diffusion rate.

Observability. This is the ease with which a product's benefits or attributes can be observed, imagined, or described to others. This is also positively related to the diffusion rate [7].

Regarding the research model related to customers' acceptance of technology adoption, there are three most popular models, namely Theory of Reasoned Action (TRA) [2], Theory of Planned Behaviour (TPB) [1], The Technology Acceptance Model (TAM) [6]. Ajzen and Fishbein [2] propose TRA, which aims to explain the relationship between attitudes and behaviours within human action. It is mainly used to predict how individuals behave from their pre-existing attitudes and behavioural intentions. There are seven factors in this framework: behavioural beliefs, outcomes evaluation, attitude toward behaviour, normative beliefs, motivation to comply, subjective norms, and behavioural intention. In the theory of planned behaviour, Ajzen [1] states that intention toward attitude, subjective norms, and perceived behavioural control, together shape an individual's behavioural intentions and behaviours.

The technology acceptance model is an information systems theory that models how users come to accept and use technology. In this framework, Davis and Bagozzi [6] suggest two primary factors influencing an individual's intention to use new technology: perceived ease of use and perceived usefulness. These factors are affected by external variables, such as social influence. When this matter (TAM) is in place, people could have the attitude and intention to use the technology. However, the perception may change depending on age and gender because everyone is different. Lastly, Unified Theory of Acceptance and Use of Technology (UTAUT) is a technology acceptance model formulated by Venkatesh and others [24]. The UTAUT aims to explain users' intentions to use an information system and subsequent usage behaviour. The theory holds that there are four key constructs: 1) performance expectancy, 2) effort expectancy, 3) social influence, and 4) facilitating conditions.

From the above-discussed theories and models and the qualitative research step, the proposed research model is drawn according to the Technology Acceptance Model with the correlation among

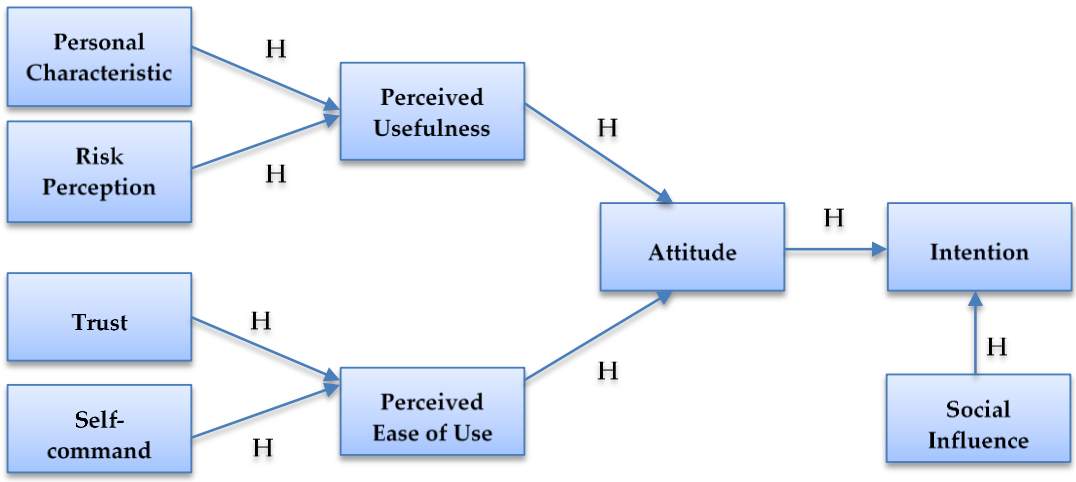

Figure 1. Proposed research model

personal characteristics, risk perception to perceived usefulness; the correlation among trust, self-command to perceived Ease of Use; and the relationship between social influence and customers' acceptance intention (Figure 1).

3 Methods

Data collection

In this study, the authors used both qualitative and quantitative data. The secondary data were collected from the department of electronic banking and the department of loan servicing at Dong A Bank – Hue branch. These data sources provide an overview of the current state of technology application, credit risks, and loan activities.

The qualitative research step then is implemented to discuss the adjusted measurement scales, proposed hypotheses, and integrated model. In this step, in-depth interview and group discussion methods were used to explore the view of eight experts (including two senior researchers who are knowledgeable about the research topic, and six experienced bankers working in different departments of Dong A Bank – Hue branch). The average time for an interview was about 60 minutes. The results of this step helped to eliminate the unsuitable variables in the proposed framework (such as confidential information about customer's banking transactions and their behaviors) and built the quantitative questionnaire.

For the quantitative research step, all the variables in the structured questionnaires were measured through the five-point Likert scale. The ratings start from 1 (strongly disagree) to 5 (strongly agree). Samples include customers who have been conducting transactions in the bank. The samples were selected by using the systematic random sampling method. The interviewer questioned the customers in turn out of the bank with a jump of $k = 3$.

The sample size was judged regarding the population means. In total, 206 respondents were interviewed, of which 11 questionnaires were unusable because of inappropriate responses and missing data. Finally, 195 questionnaires were suitable for analysis.

Sample description

The respondents consist of 58.5% men, aged 20 to over 45, with an income from 3 to over 20 million VND per month (Table 1). Regarding their perception about risks in banking transactions, most of the surveyed customers concern about the risk of time-wasting (77.2%); too many steps and

Table 1. Demographic profile

	Category	Frequency (n = 195)	Percentage (%)
Gender	Male	114	58.5
	Female	81	41.5
Age	Under 20 years old	27	13.8
	20 – 45 years old	66	33.8
	Over 45 years old	102	52.3
Income	Under 3 million VND per month	14	7.2
	3 to 10 million VND per month	107	54.9
	10 to 20 million VND per month	47	24.1
	Over 20 million VND per month	27	13.8
Risks in customers' transactions	1. The risk of time-wasting	104	53.1
	2. Too many steps and documents to do transactions	151	77.2
	3. The risk of losing money by fraud and cyberattacks	168	86.2
	4. High cost for banking cards, transaction fees, etc.	159	81.5
	5. Money transfers take long time and high costs	176	90.1
	6. Banking transactions cannot be processed during non-business hours	60	30.9

documents needed to do a transaction (86.2%); high cost for banking cards, transaction fees, etc. (81.5%); and banking transactions cannot be processed during non-business hours (90.1%).

4 Findings

4.1 Factor analyses

Exploratory factor analysis

The exploratory factor analysis (EFA) was conducted to determine the number of extracted factors on each scale. In this study, the principal components factor analysis and the Promax rotation method were applied. The results show that the measurement scale is satisfied all requirements: Kaiser–Meyer–Olkin coefficient > 0.5; the significance level of Bartlett's Test of

Table 2. EFA and CFA of the measurement models

Exploratory Factor Analysis			Confirmatory Factor Analysis				
KMO	**Sig. Bartlett's test**	**Total variance extracted**	**CMIN/ DF**	**GFI**	**TLI**	**CFI**	**RMSEA**
0.822	0.000	76.668%	1.612	0.900	0.916	0.926	0.056

Sphericity < 0.05; Eigenvalue of each extracted factor > 1; total variance extracted > 50%, and factor loading of each item > 0.5 [4, 9] (Table 2). Nine representative factors are extracted from 36 observed variables in the proposed scale, including Personal characteristics (PC), Risk perception (RP), Perceived usefulness (PU), Trust (TR), Self-command (SC), Perceived ease of use (PEU), Attitude (AT), Social influence (SI), and Intention (IN).

Confirmatory factor analysis

The confirmatory factor analysis (CFA) was conducted to test the scale reliability, convergent, and discriminant validity of the constructs. The confirmatory factor analysis allows for a more objective interpretation of validity and establish items reliability and construct's accuracy [10].

Model fit

The key indicators in the measurement model provide good fit to the data: $\chi^2/df < 3$, Comparative Fit Index (CFI) > 0.9, Goodness-of-fit index (GFI) > 0.9, Tucker & Lewis index (TLI) > 0.9, and Root Mean Square Error Approximation < 0.08), [10] (Table 2). These hypothesized models then were compared with possible alternative models. The results indicate that the hypothesized measurement models outperformed the alternative ones.

Reliability analysis

The indexes in Table 3 indicate that the reliability values of the measurement scale are higher than the recommended values: the Cronbach's alfa coefficients (Alfa) > 0.7, Composite Reliability (CR) > 0.7, and average variance extracted (AVE) > 0.5 [9]. These results mean that the research scale is reliable.

Table 3. Scale reliability analysis

Scale	Scale Reliability		
	Alfa	**CR**	**AVE**
Personal characteristics (PC)	0,931	0,914	0,679
Risk perception (RP)	0,881	0,882	0,652
Perceived usefulness (PU)	0,897	0,897	0,685
Perceived ease of use (PEU)	0,895	0,895	0,681
Trust (TR)	0,887	0,887	0,662
Self-command (SC)	0,876	0,878	0,643
Attitude (AT)	0,884	0,885	0,258
Intention (IN)	0,884	0,887	0,668
Social influence (SI)	0,878	0,906	0,723

Construct validity

The construct validity is evaluated through the convergent and discriminant. The scale achieves convergent validity if it satisfies two requirements: the standardized weights in the measurement model are higher than 0.5, significant with p-value < 0.05, and the average variance extracted (AVE) > 0.5 [10]. From the analysis results, the standardized weights range from 0.695 to 0.957, with all of the p-values less than 0.05. Besides, all of the AVE values are higher than 0.5 (Table 4).

Therefore, the measurement model in this study achieves convergent validity.

The discriminant validity assures that a variable is unique and captures the phenomena not represented by other varying constructs in the model. The Fornell–Larcker criterion is the

Table 4. Analysis of discriminant validity

	PC	RP	PU	SC	TR	PEU	AT	SI	IN
PC	***0.824*****								
RP	0,240	***0.807***							
PU	0,155	0,208	***0.828***						
SC	0,139	0,33	0,341	***0.814***					
TR	0,138	0,127	0,147	0,071	***0.802***				
PEU	0,543	0,286	0,076	0,032	0,154	***0.825***			
AT	0,318	0,483	0,214	0,332	0,271	0,315	***0.508***		
SI	0,088	0,034	0,070	0,030	0,425	0,207	0,159	***0.817***	
IN	0,353	0,384	0,422	0,325	0,317	0,313	0,463	0,173	***0.850***

Note: ** – Square root AVE of each variable – sqrt(AVE)

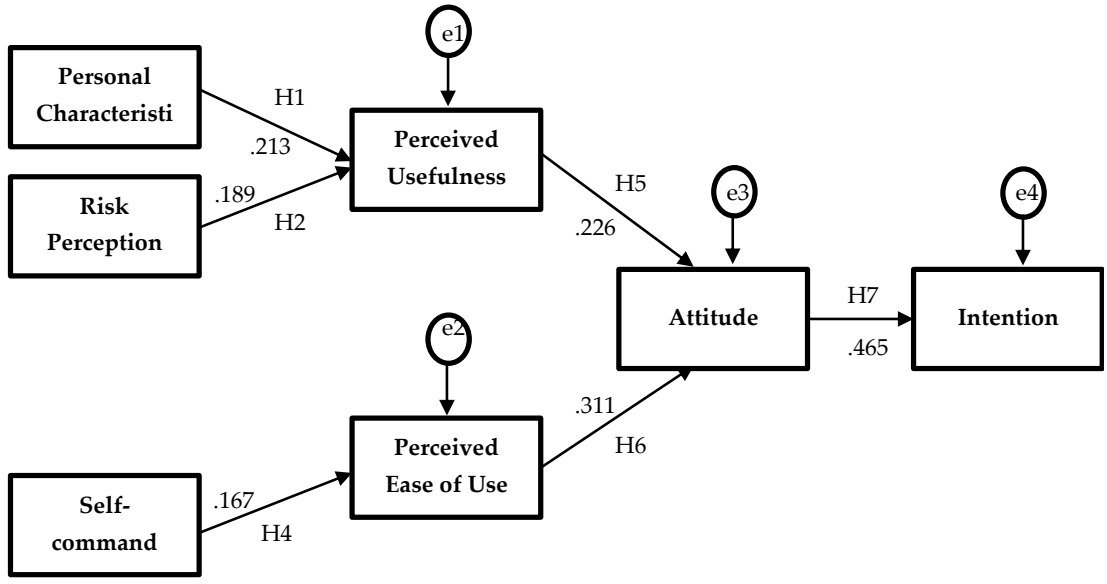

Figure 2. The results of SEM analysis

most popular method used in assessing discriminant validity. This standard requires the square root of AVE of each variable to be higher than the correlations among variables in the measurement model. The results in Table 4 show that the research model meets the these requirements.verall, the three tests mentioned above suggest that the measurement model is fit, reliable, and constructs validity.

4.2 Hypotheses testing

Structural equation modelling was used to test the developed hypotheses. From the analysis results, among eight tested relationships, six are supported with the *p*-value ranging from 0.00 to 0.05. Namely, Personal characteristics and Risk perception positively affect Perceived usefulness, with the standardized regression weights of 0.213 and 0.189, respectively. The Perceived ease of use factor is only affected by Self-command with the parameter estimate of 0.167. Meanwhile, the relationship between Perceived ease of use and Trust is not significant with the *p*-value of 0.697.

Notably, Perceived usefulness and Perceived ease of use positively and strongly affect Attitude of customers about accepting the adoption of blockchain technology at Dong A Bank – Hue branch. Their standardized regression weights are 0.226 and 0.311, respectively. Similarly, Attitude also strongly affects the acceptance Intention of customers, with the parameter estimate of 0.465. Conversely, the Social influence factor does not show a clear and strong correlation with the acceptance Intention with the *p*-value of 0.126.

4 Discussion and conclusion

Blockchain abilities allow banks to significantly transform their businesses to a new level, reducing excessive bureaucracy, conducting faster transactions at lower costs, and improving its secrecy. However, to bring this technology into reality, banks need the acceptance of customers. Identifying factors affecting customers' approval, thus becomes the top concern of bank leaders and scholars around the world. In this study, the authors develop and test the integrative model of factors affecting the attitude and acceptance intention of customers at Dong A Bank – Hue branch.

Regarding the measurement scales, the study finds that besides two primary factors influencing an individual's attitude and intention to use new technology: Perceived ease of use and Perceived usefulness. Personal characteristics, Risk perception, Trust, and Self-command are also important indirect factors to build customers' belief and their acceptance of blockchain adoption. This finding helps to improve the original model of Davis and Bagozzi (1992).

Referring to risks perceived by customers in their banking transaction, the risk of losing money by fraud, cyberattacks, high cost for banking cards, transaction fees, etc. are major perceived risks. This emphasizes the potential application of blockchain in Dong A Bank – Hue branch. These results are quite similar to those of customers in other countries, such as the US [16] and China [23].

Finally, from applying structural equation modelling, six out of eight tested relationships are supported. Perceived usefulness and Perceived ease of use are the most critical factors affecting customers' Attitude. This is supported by many studies. Similarly, Attitude also has a direct and strong correlation to customers' acceptance Intention. Besides, because Risk perception and Personal characteristics reflect the extent of customers' willingness to learn new technology, these factors have a positive and direct relationship to customers' Perceived usefulness. Similarly, with high Self-command ability, customers could learn new technology easily and have Perceive ease of using blockchain applications.

From the analysis results and group discussion among bank managers and blockchain experts, the study offers six groups of solutions to enhance the applicability of blockchain technology at Dong A Bank – Hue branch. Specifically, the bank should add all parties involved in banking transactions into blockchain systems, and fostering an uncommon coordination among banks to help transform payments at scale and help reduce the risk of failure. Further, the bank needs to release a trial version of the blockchain applications for customers to experience, evaluate, and perfect the application. The additional information about blockchain's enormous potential benefits and positive impacts is also needed to be provided adequately to customers (through marketing campaigns, advertising pieces, and guidelines) to reduce the risk concerns or uncertainty of service users.

Furthermore, a control system (including the necessary defined rights, obligations, controls, and standards) and a customer assistant system are also necessary for improving customers' Perceived ease of use. Finally, the bank needs to build back-up plans for the situation when the blockchain system is disrupted or does not achieve the expected outcomes.

In conclusion, from blockchain application theories and customers' acceptance models, this study helps Dong A Bank – Hue branch identify and analyse factors affecting customers' acceptance intention on the adoption of blockchain technology. Regarding the limitation of this study, the collected data have certain shortcomings. This is rooted in the relative evaluation criteria and subjective opinions of interviewees. Therefore, in the future, there should be further research with a broader research scope, data collected in research in the whole banking system. Moreover, there should be new studies focusing on clarifying the features of the blockchain applications to overcome all struggles identified in this study.

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