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FACTORS IMPACTING BLOCKCHAIN ADAPTATION IN DATA TRANSFER AMONG COMMERCIAL BANKS IN VIET NAM

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Abtract

While blockchain has great potential to revolutionize many industries, especially banking and finance, its adoption rates remain low in developing countries. This lower-than-expected adoption and a lack of research on blockchain adaptation from a sociological perspective are the main motivation for the study about blockchain adaptation in data transfer among commercial banks in Vietnam. Modified UTAUT model and questionnaire survey with 385 bankers in 31 commercial banks were used to identify the most important factors impact Blockchain adaptation in data transfer of Vietnam commercial banks. The findings revealed that regulatory support moderates the impact of trust and technology affinity on blockchain adoption, which has not been examined by prior research in developing countries like Vietnam. The study also examines the blockchain adaptation in data transfer in a developing country, which is a novelty area compared with previous literature. Furthermore, effort expectancy, facilitating conditions, performance expectancy were found to positively influence adoption, equipping employees with requisite blockchain knowledge and skills will be crucial to adopting these innovations.

Keywords: Blockchain adaptation, data transfer, commercial banks, Vietnam, UTAUT

1. INTRODUCTION

The development of technology has been a driving force behind major advancements and transformations in various aspects of human life. The rise of emerging technologies opens up

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different prospects for businesses to enhance their competitiveness. Blockchain represents an innovative and decentralized computing system. Its distinctive operational principles and the ability to trace records ensure the integrity, indisputability, and security of transaction data. Consequently, Blockchain is well-suited for constructing a distributed and decentralized TT infrastructure (Nair et al., 2022). However, there has been little academic research conducted on Bl's values in data transfer among commercial banks. The objective of this study is to present a theory relating Blockchain, data transfer, and commercial banks. By analyzing the real situation of applying Blockchain to data transfer among commercial banks in Vietnam, we suggest some solutions encouraging and improving Blockchain adoption in this context.

Accordingly, this research will answer the following questions: What is the current status of Blockchain adoption in data transfer among commercial banks in Vietnam? How do these factors including performance expectancy, facilitating conditions, technology readiness, trust, technology affinity, and regulatory support affect the adoption of Blockchain in data transfer among commercial banks in Vietnam? What are suggestions for banks and the government to make Blockchain more suitable for the Vietnam landscape?

The paper's remainder is structured as follows: Section 2 - Literature review; Section 3 - Theoretical framework; Section 4 - Methodology; Section 5 - Findings; Section 6 - Discussion; Section 7 - Limitations; Section 8 - Conclusion.

2. LITERATURE REVIEW

2.1. *Overview of Blockchain Technology*

Blockchain is a decentralized technology for data management and transactions that was initially created for the Bitcoin cryptocurrency (Yli-Huumo et al., 2016; Yaga et al., 2018). Blockchain has received extensive attention recently and become a catchword in the recent technological era (Zheng et al., 2017; Bansod & Ragha, 2020).

Blockchain technology has gone through several stages of development since its inception. Blockchain's first development context of research is technology improvement that is directly related to various features of the Blockchain (Zheng & Lu, 2021). At this stage of Blockchain's development, academics focused on the various forms of Blockchain (public versus private, permissionless versus permission), the well-known Blockchain platforms (Hyperledger Fabric, Ethereum), advancements in Blockchain mining technology, and DLT. The second development context of Blockchain research is research and development (Zheng & Lu, 2021). In this stage, researchers are working to incorporate Blockchain into various fields to address issues that cannot be resolved (Chod et al., 2020; Ali, Ally, & Dwivedi, 2020), including Blockchain-based applications in FinTech (Assarzadeh & Aberoumand, 2018), Supply chain management, IT governance, marketing, the airline industry, etc. The third development context of Blockchain research is its adoption and absorption (Zheng & Lu, 2021). It means that the ability of an organization to implement and assimilate Blockchain is essential for the creation of Blockchain-related business values..

Several researchers have taken into consideration how Blockchain operates. These mechanisms share many key components and are generally fairly similar, focusing on decentralization. It embeds consensus mechanisms and protocols to realize data transmission from one party to another (Nakamoto, 2019; Yang et al., 2019). A decentralized database of a ledger-proofed transaction system indicates that the Blockchain is shared throughout the network nodes. Each network node has the authority to check the operation of other nodes in the network to generate, verify, and validate the new transactions of the Blockchain network.

2.2. Blockchain technologies adaptation in some fields

In terms of BC applications in SCM (SCM), a variety of research has been conducted. With advantages like transparency (Lu & Xu, 2017), trustworthiness (Zou et al., 2019), and cost-effectiveness (Kshetri, 2018), BC can support SCM to overcome drawbacks relating to sophisticating networks and ensure security (Queiroz et al., 2020). BCT also helps to limit counterfeit products (Singh & Singh, 2016), ensuring authenticity through restricted SCs (Saberi et al., 2019b). Examples that prove the reliability of BCT are Walmart and Glencore adopting BCT in their SC.

Researchers also point out that business process management (BPM) has used BCT to address the current challenges and modernize the working process (Mendling et al., 2018). BCT is the crucial key as a technological solution (Zheng et al., 2017) to tackle business problems. This innovative technology provides valuable cost savings by allowing transactions to be conducted in a P2P method directly among legal entities or individuals. BCT also serves as an immutable ledger for tracing messages and encryption restricts public data visibility and limits other data access.

Since the existence of BC 3.0, it is noticeable that the healthcare industry also adopted BCT in its operations and this technology brings enormous benefits to doctors, patients, and other institutions as well (Zhao et al., 2016). The distributed ledger architecture of BC ensures that medical data is stored and accessible in a decentralized manner rather than being concentrated in a single centralized location. The MIT Media Lab Beth Israel Deaconess Medical Center, the Gem Health Network, and Healthbank have demonstrated the importance of BCT in recording electronic medication (Azaria et al., 2016). Other research by Androulaki et al. (2018), a project launched by Hyperledger also showed the BCT application in avoiding counterfeit drugs.

Apart from previous industries, BCT is also used in the education sector and has lots of direct benefits for teachers and students. BCT appears as a solution for supporting academic degree management and comprehensive evaluation (Sharples & Domingue, 2016). As the research of Mikroyannidis, Domingue, Bachler, and Quick (2018), BCT is like a revolutionization in education when it brings learners, including both teachers and students to life-long learning. The University of Nicosia, Sony Global Education, Massachusetts Institute of Technology (MIT) and the Learning Machine company, and Holberton School used BCT in their operations of managing students' ID and degree as well as tracking students' learning behavior (Hoy, 2017; Skiba, 2017).

The financial services sector can gain significant benefits from advances in BCT. Thanks to BCT, a third party in the financial transaction is not needed and helps minimize credit or cyber risks. In addition, BC has several applications in the insurance sector which enables the use of smart contracts to automate claim processing and payments, reducing fraud through transaction transparency (Kar & Navin, 2021). Experiments with the record-keeping underlying Bitcoin, allow organizations to gain deeper insight into important financial trends like credit default swaps (Nguyen, 2016). BC even helps businesses to separate 2 processes: transferring and saving money. In general, BCT brings diverse ways for financial services.

2.3. Blockchain technologies adaptation in the banking system

BCT has gained much attention from financial institutions as well as banking systems (Guo & Liang, 2016). As pioneers in applying technology to business, banks have strengthened their competitive edge by automating workflows with modern tools that upgrade products and services while decreasing labor costs, enhancing the user experience, and boosting profits (Pham, 2022). The Indian banking system can enhance current operations and customer experience thanks to BCT with automation in inter-organization. In 2016, a survey was carried out by McKinsey involving banking executives worldwide. The findings revealed that roughly half of the executives polled believed BC would have significant effects within 3 years.

There is a positive sign that BCT is adopted widely in commercial banks and they even begin to apply this technology in every business operation (Wu & Duan, 2019). The Brazilian Development Bank and Chinese banks also utilize BCT to resolve credit risks, which demonstrates interactions between banking operations and technology innovation (Arantes et al., 2018). According to Patki and Sople (2020), the State Bank of India is deploying BCT in reconciliation, remittances, and trade finance operations. However, Mr. Patki and Sople also indicated that only five private banks, one public sector bank, and two foreign banks are using BCT in India, meanwhile, they have 27 public sector banks, 23 private (large-size) banks, and 46 foreign banks. The others just show their interest in this kind of innovation without any specific planning. Throughout those researches, the BA in commercial banks worldwide is still humble, but it also has some positive points in banks' using intention (Chowdhury et al., 2021).

2.4. Blockchain technologies adaptation in data transfer among commercial banks

Applications and implementations based on Blockchain technology have improved data management (Asharaf & Adarsh, 2017); additionally, because all of their operations can be verified, they have made default auditability easier (Sutton & Samavi, 2017; Neisse et al., 2017). The promising outcomes indicate that Blockchain can function as a foundation for managing workflows across different organizations. Even though Blockchain is becoming more and more popular, not all companies are using it because it doesn't improve their systems or because there aren't enough regulations (Summit, 2017).

Blockchain provides several key benefits to data transfer among commercial banks. By recording transaction data on a distributed ledger using cryptography, Blockchain improves security and ensures all parties have access to transparent and identical records. In cross-border payment, the use of Blockchain in payments could allow for the direct execution of bank-to-bank transactions without the involvement of third parties, bringing with it several benefits like increasing security (Wu & Duan, 2019a; Martino, 2019). In another study, the Ripple payment network, which is based on Blockchain, enables nearly cost-free money transfers (Buitenhek, 2016; Fanning & Centers, 2016; Guo & Liang, 2016) among countries in a variety of forms, and it can instantly settle high-value payments (Wu & Duan, 2019a).

However, there are several issues with Blockchain, including whether or not it can eventually process data quickly enough for an automated clearing house, whether it will be less expensive than traditional payment methods, and whether or not it will be able to limit the amount of wasted mining power when higher transaction volumes are involved (Cocco et al., 2017). Other studies (McDonald et al., 2016; Holotiuk et al., 2017) assert that because Blockchain allows banking transactions to move from centralized hierarchical organizations back into a decentralized market, it may pose a threat to banks' operations, particularly as a new competitor.

Many financial institutions have started trying to apply Blockchain to financial transactions due to its advantages and the general trend of global technological development. An empirical research conducted by Wang et al. (2019) has brought an overview of the results of Blockchain applications in banks in some countries in the world, including China, Japan, South Korea, and Singapore. According to that, Chinese companies account for 57% of the top 100 companies leading in Blockchain patents in 2018. In addition, approximately around 80 banks are doing research with that platform, such as Currencies Direct (London), dLocal (Uruguay), Bexs Banco (Brazil), Credit Agricole (France), MUFG Bank (Japan), etc.

Vietnam sees growing potential in blockchain (Blockchain) adoption. Many of its banks are pursuing innovative technologies like Blockchain. Over 2,000 people engaged at a 2016 Blockchain event in Vietnam. It is also gaining prominence as a major partner for Korean Blockchain projects seeking attractive markets like Vietnam. With a young, dynamic population and stable economy matching tech innovation pace, Vietnam can become a Southeast Asian Blockchain hub if its government supports more Blockchain study. Meanwhile, some banks like HSBC and HDBank are experimenting with blockchain applications for letters of credit and facilitating trade finance, blockchain currently occupies only 5% of Vietnam's fintech services according to research. With the banking industry still developing, this study aims to provide insight into blockchain adoption for data transfer among Vietnam's commercial banks and help realize their strategic long-term goals through specialized staff and following technological advances.

2.5. The unified theory of acceptance and use of technology - UTAUT

Viewing the existing literature, a series of theoretical models for technology adoption has been developed, including eight prior prevailing theories and models: Theory of Reasoned Action (Fishbein & Ajzen, 1975), the Technology Acceptance Model (Davis, 1989), Motivational Model (Davis et al. 1992), Theory of Planned Behavior (Ajzen, 1991), Combined TAM and TPB (Taylor & Todd, 1995), Model of PC Utilization (MPCU) (Thompson et al., 1991), Innovation Diffusion Theory (Moore & Benbasat, 2001), and Social Cognitive Theory (Compeau et al., 1999). To harmonize the literature on acceptance of new technology, Venkatesh et al. (2003) created the unified theory of acceptance and use of technology (UTAUT), a unified model that integrates divergent perspectives on user and innovation acceptance. According to Venkatesh et al. (2003), PE, EE, social influence, and FC are the four core constructs that the UTAUT proposes are direct determinants of behavioral intention (Gruzd et al., 2012; Chiu et al., 2010). These constructs are further moderated by gender, age, experience, and voluntariness of use (Venkatesh et al., 2003; Carls-son et al., 2006).

It has been noted that a great deal of research on technology adaptation in the banking industry has been conducted in recent years. Little previous studies presented mixed empirical findings about the impact of UTAUT constructs on usage intention and usage behavior such as PE (Mahfuz et al., 2016c; Merhi et al., 2019), EE (Gupta et al., 2019; Yu, 2012), social influence (Bankole et al., 2011; Tan & Lau, 2016), and FCs (Albashrawi et al., 2017; Oliveira et al., 2014).

In our research study, based on the review of UTAUT's application in previous technology acceptance contexts, we established three main factors including PE, EE, and FC to research the possibility of applying Blockchain in data transfer among commercial banks. Moreover, we chose to exclude the Social Influence (SI) and incorporate Technology Readiness (TR), trust (TT), and Technology Affinity (TA) (Kamble et al., 2019; Larasati & Santosa, 2017; Pattanshetti et al., 2016) as additional independent variables in our research framework. Besides, Regulatory Support (RS) is adopted as the moderator in our research rather than using the moderators from the original UTAUT model (Dwivedi et al., 2017; Dwivedi et al., 2019).

3. THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

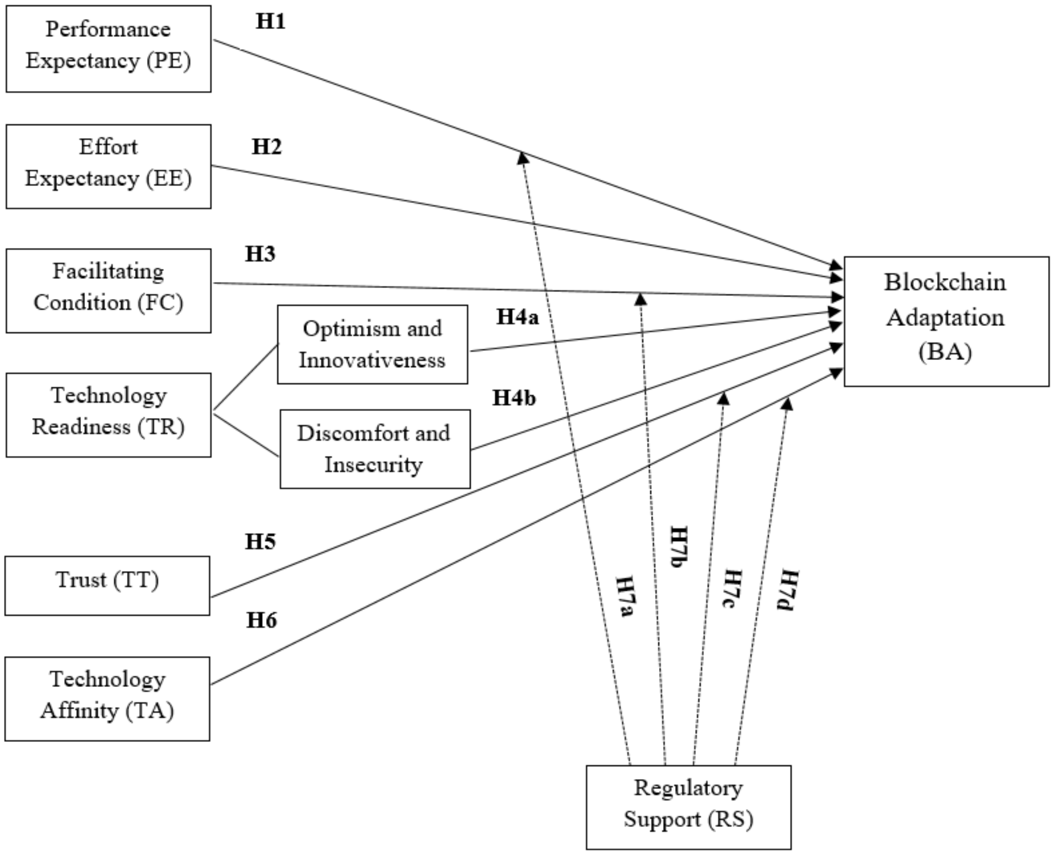

Figure 1: Theoretical framework

3.1 Performance Expectancy (PE)

PE is defined as "the degree to which an individual believes that using the system will help him or her attain gains in job performance" (Venkatesh et al., 2003). Numerous studies in the past confirmed that PE has an impact on the adoption of technology through diverse technological contexts (Alraja, 2015). This study examines how the belief of commercial banks in the effectiveness of blockchain technology for data transfer impacts its adoption. We decided to derive the following hypothesis:

H1. PE (PE) has a positive influence on Blockchain Adaptation (BA)

3.2 Effort Expectancy (EE)

EE is defined as "the degree of ease associated with consumers' use of technology" (Venkatesh, Thong & Xu 2012, p. 159). Users are more likely to adopt technology when they find it easy and convenient to use and don't need to put in much effort to learn it (Tan & Ooi, 2020, p. 4). EE plays an important role in affecting the users' intention to adopt new technology (Chao, 2019). In this study, commercial banks would be more inclined to use Blockchain if they found it simple to use. Accordingly, the following hypothesis is formulated:

H2. Effort expectancy (EE) has a positive influence on Blockchain Adaptation (BA)

3.3 Facilitating Condition (FC)

Alazab et al. (2020) defined Facilitation of conditions as the recognition of the available resources within organizations that promote the adoption and utilization of Blockchain. FC is a significant predictor of behavioral intention to utilize Blockchain (Venkatesh, Thong, & Xu 2012). The influence of FC on behavioral intention on Blockchain adoption can be examined by considering the presence of technical assistance, the availability of hardware and software, and the understanding of the system as well (Lallmahomed et al., 2013). As a result, this study introduces that if commercial banks perceive that they possess the essential technological infrastructure support, they tend to adopt Blockchain into data transfer. Thus, this leads to the following hypothesis:

H3. Facilitating Condition (FC) has a positive influence on Blockchain Adaptation (BA)

3.4 Technology Readiness (TR)

TR is defined as "individual or organizational predispositions to embrace new technologies" (Balasubramanian et al., 2021, p.5). The optimism and innovativeness can be considered drivers of commercial banks' willingness and openness to adopt new technologies. In contrast, the discomfort and insecurity dimension act as inhibitors to new technology adaptation. (Nugroho et al., 2017; Jaafar et al., 2007). Based on this, the following hypothesis is formulated:

H4a: Technology Readiness (TR) - optimism and innovativeness has a positive influence on Blockchain Adaptation (BA)

H4b: Technology Readiness (TR) - discomfort and insecurity has a negative influence on Blockchain Adaptation (BA)

3.5 Trust (TT)

TT refers to the readiness of one individual or entity to believe in and depend on another in intricate and unpredictable circumstances (Gefen, Karahanna & Straub, 2003). The more TT a user places in a technology to perform as expected, the stronger their intentions are to keep utilizing and implementing that technology on an ongoing basis. (Vatanasombut et al., 2008). TT enables the user firm to build a long-term relationship with the technology (Kim et al., 2010b).Confidence in blockchain's potential to enhance data transmission workflows encourages commercial banks to invest in the necessary infrastructure for integration. Based on this discussion the following hypotheses is formulated:

H5: Trust (TT) has a positive influence on Blockchain Adaptation (BA)

3.6 Technology Affinity (TA)

According to Franke, Attig and Wessel (2019) indicated that TA is the inclination of an individual to actively engage or avoid technology as a way to adapt and manage its impact. As users become more skilled in specific technology, they perceive less effort required and achieve higher levels of performance (Wong et al., 2020). This optimism stems from the belief that Blockchain can bring significant benefits and improvements to their data transfer processes. Consequently, we have the following hypothesis:

H6: Technology Affinity (TA) has a positive influence on Blockchain Adaptation (BA)

3.7 Regulatory Support (RS)

RS refers to the assistance provided by government authorities to encourage firms to adopt and integrate information technology innovations (Zhu et al.; 2006). If perceived government support for the adoption of Blockchain is high, the companies' performance will increase. With the goal of making Blockchain easier to implement across various industries (including banking and financial services) and financial institutions gain greater performance, the government of Vietnam is currently developing new IT laws and regulations. Thus, the following hypothesis is made to identify the impact of these government regulations towards PE which finally affects users' behavioral intention:

H7a. Regulatory support (RS) moderates the impact of PE on Blockchain Adaptation (BA)

The Technology-Organization-Environment (TOE) theory also puts RS as the most significant component of the environment factor that affects businesses' technology adoption (Tornatzky & Fleischer, 1990). The significant point is that these systems include important users' data which are encrypted into blocks and nodes (Zyskind, Nathan, & Pentland, 2015). Therefore, this kind of technology requires wide resources relating to infrastructure (computing system, network bandwidth, servers, etc.). With its characteristics, some questions are promoted such as is it safe, is it easy to apply into business operation. To gain in-depth knowledge of some factors affecting Blockchain adoption decisions of commercial banks, we come to our hypotheses:

H7b: Regulatory Support (RS) moderates the impact of Facilitating Conditions (FC) on Blockchain Adaptation (BA)

Both TT and regulation can be applied together and each can serve to reinforce the other (Das & Teng, 1998). Similarly, TA is the inclination of an individual to actively engage or avoid technology as a way to adapt and manage its impact. With the help of regulation, banks have more TT in engaging technology, or Blockchain in specific, to adapt its advantages. Therefore, RS provided by the government can boost companies' confidence in adopting new technologies, making them more open to adopting Blockchain solutions. Accordingly, it is hypothesized that

H7c: Regulatory Support (RS) moderates the impact of Technology Readiness (TR) on Blockchain Adaptation (BA)

H7d: Regulatory Support (RS) moderates the impact of Trust (TT) on Blockchain Adaptation (BA)

4. METHODOLOGY

4.1. *Procedure*

The research paper delivered questionnaires on 385 bankers from 31 commercial banks in Vietnam. According to Yamane Taro (1967) in case of unknown population size, we will calculate using the following formula:

$$n = Z^2 \text{ x } \frac{p \, x \, (1-p)}{e^2}$$

With:

n: the sample size to be determined.

Z: the value obtained from the Z distribution table based on the chosen confidence level. Typically, a 95% confidence level is used, corresponding to Z = 1.96.

p: the estimated proportion of the sample n being successful. We typically choose p = 0.5 to make the value p(1-p) the largest, ensuring the sample n provides safe estimate.

e: the tolerated margin of error. Common margin of error rates used are: ±01 (1%), ±0.05 (5%), ±0.1 (10%), with ±0.05 being the most popular.

Therefore, we have the sample size of our research as follow:

$$n = 1.96^2 \text{ x } \frac{0.5 \, x \, (1-0.5)}{0.05^2} = 384.16$$

The participants' age ranges from 22 to above 50 years old with working experience less than 1 year to more than 20 years. Bankers are from various departments in banks such as Human Resource, Research and development and Finance. They come from 31 commercial banks in Vietnam with a size ranging from 1000 – above 20000 employees (according to the Financial Statement of 31 banks). The questionnaire used the seven-point Likert scale (from strongly disagree to strongly agree).

4.2 Constructs and operationalisation

The research used Smart PLS software for the proposed framework and SPSS for demographic analysis. One reason for using the PLS approach was to predict rather than confirming the model (Hair et al., 2011). 6 independent variables are main factors that will impact BA. The moderator RS will affect the relationship between independent variables and dependent variables. The variables were adapted from Venkatesh et al. (2003) for PE. For EE, the research paper adapted from Alraja (2015), Chang et al. (2007). FC was adapted from Venkatesh, Thong, and Xu (2012) and Yousafzai et al. (2012) for TR. TT was adapted from Liao et al. (2006) and Franke, Attig, and Wessel. (2019) for TA. Moderator RS was adapted from Zhu et al. (2006). Constructs for BA were adapted from Venkatesh et al. (2003).

4.3 Demographic analysis

The descriptive statistics of respondents from SPSS showed that the top two departments of the respondents for this study are from Risk management (13,2%) and Finance (11,2%) in which the majority have been with the organization between 1 - 2 years (26,2%) and 6 - 10 years (17,9%). More than 80% of the respondents indicated that their companies have not adapted Blockchain and about 47,5% responded that their banks are learning and doing research about Blockchain. In terms of Blockchain impact, 29,1% respondents believed that Blockchain will have an impact on their company's work, especially in data transfer in the near future.

Demographic measures		Frequency	Percentage
Gender	Male	165	42,9
	Female	220	57,1
Age	22 - 25 years old	85	22,1
	25 - 29 years old	77	20
	30 - 39 years old	77	20
	40 - 44 years old	55	14,3
	45 - 49 years old	55	14,3
	50 and above	36	9,4
Workplace	Vietcombank	24	6,2
	Vietinbank	14	3,6
	Techcombank	20	5,2
	BIDV	24	6,2
	MB	20	5,2
	VPBank	12	3,1
	ACB	15	3,9
	Agribank	12	3,1
	TPBank	14	3,6
	SHB	16	4,2
	HD Bank	13	3,4
	SCB	4	1
	Sacombank	5	1,3
	VIB	9	2,3
	MSB	6	1,6
	Seabank	13	3,4
	OCB	16	4,2
	Eximbank	16	4,2
	LP Bank	11	2,9
	PVcomBank	14	3,6
	Bac A Bank	12	3,1
	ABBank	10	2,6
	Dong A Bank	7	1,8
	BaoViet Bank	11	2,9
	NamA Bank	10	2,6
	VietBank	13	3,4
	Viet A Bank	13	3,4
	National Citizen Bank	8	2,1
	BV Bank	9	2,3
	Saigonbank	7	1,8
	Saigon-Hanoi Bank	7	1,8
Working duration	Less than a year	59	15,3
	1 - 2 years	101	26,2
	3 - 5 years	66	17,1
	6 - 10 years	69	17,9
	11 - 20 years	55	14,3
	Above 20 years	35	9,1

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	ACB	15	3,9
	Agribank	12	3,1
	TPBank	14	3,6
	SHB	16	4,2
	HD Bank	13	3,4
	SCB	4	1
	Sacombank	5	1,3
	VIB	9	2,3
	MSB	6	1,6
	Seabank	13	3,4
	OCB	16	4,2
	Eximbank	16	4,2
	LP Bank	11	2,9
	PVcomBank	14	3,6
	Bac A Bank	12	3,1
	ABBank	10	2,6
	Dong A Bank	7	1,8
	BaoViet Bank	11	2,9
	NamA Bank	10	2,6
	VietBank	13	3,4
	Viet A Bank	13	3,4
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Figure 2: Demographic analysis

5. RESULTS

5.1 The measurement model

Indicator reliability

The outer loading coefficient can be used to assess the quality of the variables in a model. According to Hair et al. (2013), an ideal outer loading value is 0.7 or above, if not, it may not strongly contribute to its correlating factor and could be removed. After examining the outer loadings using SmartPLS 3.0 in this study, all variables had an outer loading greater than 0.7, so they were kept in the model

	Outer Loadings
BA1	0,865
BA2	0,819
BA3	0,832
BA4	0,852
EE1	0,889
EE2	0,873
EE3	0,893
EE4	0,873
FC1	0,864
FC2	0,838
FC3	0,853
FC4	0,852
Facilitating Condition (FC) * Regulatory Support (RS)	1,014
PE1	0,895
PE2	0,853
PE3	0,869
PE4	0,866
Performance Expectancy (PE) * Regulatory Support (RS)	0,868
RS1	0,909
RS2	0,882
RS3	0,887
RS4	0,868
TA1	0,886
TA2	0,890
TA3	0,885
TA4	0,910
TR1	0,877
TR2	0,901
TR3	0,878
TR4	0,883
TR5	0,904
TT1	0,888
TT2	0,890
TT3	0,893
TT4	0,889
TT5	0,876
Technology Affinity (TA) * Regulatory Support (RS)	0,730
Trust (TT) * Regulatory Support (RS)	0,733

Figure 3: Outer loading coefficient

Construct reliability

The study further assessed construct reliability by examining the composite reliability (CR) and Dijkstra-Henseler's rho (ρA) values (Teo et al., 2015a; 2015b). The lowest CR and ρA values observed were 0.907 and 0.870 respectively, exceeding the recommended minimum threshold of 0.7 for both measures. Therefore, the measurement model demonstrated good reliability

	Cronbach's Alpha	rho_A	Composite Reliability
BA	0,864	0,870	0,907
EE	0,905	0,905	0,934
FC	0,874	0,876	0,914
PE	0,894	0,897	0,926
RS*FC	1,000	1,000	1,000
RS*PE	1,000	1,000	1,000
RS*TA	1,000	1,000	1,000
RS*TT	1,000	1,000	1,000
RS	0,909	0,912	0,936
TA	0,915	0,920	0,940
TR	0,934	0,937	0,949
TT	0,933	0,936	0,949

Figure 4: Composite Reliability and rho_A

Convergent validity

Convergent validity refers to the model's ability to explain the indicator's variance. The AVE can provide evidence for convergent validity (Fornell & Larcker, 1981). The study found that the average variance extracted (AVE) values for all constructs were higher than the recommended threshold of 0.5, indicating satisfactory convergent validity (Bagozzi & Yi, 1988).

	Average Variance Extracted (AVE)
BA	0,710
EE	0,778
FC	0,726
PE	0,758
RS*FC	1,000
RS*PE	1,000
RS*TA	1,000
RS*TT	1,000
RS	0,786
TA	0,797
TR	0,790
TT	0,788

Figure 5: Average Variance Extracted (AVE)

Discriminant validity

Discriminant validity refers to the degree to which constructs actually differ from each other based on empirical evidence. To assess discriminant validity, our research use HTMT. The HTMT criterion involves comparing calculated values to a predefined cutoff of 0.9. If the

HTMT exceeds this threshold between two constructs, it can be concluded they lack sufficient discriminant validity. According to Figure 6, discriminant validity is satisfied in all constructs with the highest value of 0,884.

	BA	EE	FC	PE	RS*FC	RS*PE	RS*TA	RS*TT	RS	TA	TR	TT
BA												
EE	0,405											
FC	0,626	0,608										
PE	0,476	0,798	0,524									
RS*FC_	0,577	0,203	0,747	0,151								
RS*PE	0,436	0,401	0,179	0,705	0,163							
RS*TA	0,301	0,620	0,444	0,627	0,347	0,549						
RS*TT	0,145	0,615	0,434	0,608	0,374	0,585	0,679					
RS	0,341	0,854	0,621	0,818	0,273	0,454	0,590	0,604				
TA	0,352	0,842	0,642	0,800	0,312	0,519	0,532	0,684	0,884			
TR	0,359	0,865	0,619	0,817	0,282	0,491	0,667	0,653	0,859	0,882		
TT	0,534	0,874	0,644	0,819	0,302	0,502	0,681	0,520	0,874	0,860	0,847	

Figure 6: Heterotrait-Monotrait ratio of correlations (HTMT)

Path coefficient

The results of the hypotheses testing with the p-values are shown in Figure 7. P value for all Hypotheses are validated except for H4 (p value > 0.05). EE, FC, PE and TT were positively related to BA. In contrast with our hypothesis, TA negatively correlated with BA. RS negatively moderates the relationship between FC and PE with BA and positively moderates the relationship between TA and TT with BA.

	Original Sample (O)	P Values
EE -> BA	0,328	0,002
FC -> BA	0,192	0,007
PE -> BA	0,197	0,012
RS*FC -> BA	-0,504	0,000
RS*PE -> BA	-0,541	0,000
RS*TA -> BA	0,258	0,001
RS*TT -> BA	0,598	0,000
RS -> BA	-0,210	0,006
TA -> BA	-0,247	0,001
TR -> BA	-0,051	0,323
TT -> BA	0,332	0,002

Figure 7: P value and Original sample

Collinearity Assessment

The study examined the variance inflation factor (VIF) to identify any highly correlated constructs. The results showed that the highest VIF value among all exogenous constructs was 3.489, which is below the commonly used limit of 5 (Chuah et al., 2017).

	VIF
BA1	2,198
BA2	1,955
BA3	2,026
BA4	2,073
EE1	2,817
EE2	2,477
EE3	2,852
EE4	2,465
FC1	2,241
FC2	2,082
FC3	2,111
FC4	2,137
Facilitating Condition (FC) * Regulatory Support (RS)	1,000
PE1	2,796
PE2	2,275
PE3	2,512
PE4	2,333
Performance Expectancy (PE) * Regulatory Support (RS)	1,000
RS1	3,112
RS2	2,698
RS3	2,777
RS4	2,437
TA1	2,905
TA2	2,849
TA3	2,653
TA4	3,163
TR1	3,101
TR2	3,503
TR3	3,071
TR4	3,244
TR5	3,489
TT1	3,039
TT2	3,331
TT3	3,181
TT4	3,005
TT5	3,071
Technology Affinity (TA) * Regulatory Support (RS)	1,000
Trust (TT) * Regulatory Support (RS)	1,000

Figure 8: VIF value

5.2 The structural model

Coefficient of Determination (R^2):

As per Wong, Tan, Loke et al. (2015), R^2 values for endogenous variables are assessed based on thresholds where 0.75 indicates substantial, 0.5 represents moderate, and 0.25 reflects weak explanatory power. In this study, the R^2 value for the endogenous variable presented a moderate accuracy of 66.1%. This means the constructs moderately explained the variance in BA.

	R Square	R Square Adjusted
BA	0,661	0,651

Figure 9: R Square

F^2 value and Q^2 value

The study also evaluated the effect sizes by calculating Cohen's f^2 values based on the following suggested guidelines: 0.02 indicates a small effect, 0.15 represents a medium effect, and 0.35 denotes a large effect. Most of the independent variables were found to have Cohen's f^2 effect size values that fell within the small to medium range. Additionally, the model's predictive ability was assessed using the Stone-Geisser Q^2 value (Geisser, 1974). The Q^2 value calculated for BA in this study was 0.455, which is greater than zero. According to the general rule of thumb, a Q^2 value above zero indicates the model has predictive relevance (Tan et al., 2018)

	BA
BA	
EE	0,073
FC	0,029
PE	0,026
RS*FC_	0,276
RS*PE	0,244
RS*TA	0,033
RS*TT	0,164
RS	0,031
TA	0,032
TR	0,002
TT	0,054

Figure 10: F^2 value

6. DISCUSSION

6.1 Key findings

PE, EE, and FC were found to significantly influence behavioral intention. Additionally, the model was expanded to include three new constructs - TR, TT, and TA. However, only TT and TA significantly impacted behavioral intention to adapt to Blockchain, while TR did not. Furthermore, the study validated the moderating effect of RS on the relationships between FC, PE, TA, TT and behavioral intention.

The findings were consistent with prior work (Zhou, Lu & Wang, 2010) that found a positive relationship between PE and intention to adopt blockchain technology. This relationship is explained through a utilitarian perspective where individuals evaluate technologies based on their ability to help achieve goals and maximize benefits versus costs. In the work domain, activities that facilitate performance hold value. When blockchain is seen as optimizing workflows and enabling analysis, it triggers usefulness evaluations. However, AlAwadhi et al. (2008) and Saberi et al. (2019) noted that embracing new technologies requires experience, as respondents with more exposure have realized the benefits of using the technology. In addition, there is still research proven that PE was insignificant to technology adaptation (Birch & Irvine, 2009) in education. Therefore, for different fields of implementation, there are still differences in participants' perspectives relating to the same issue.

The findings showed a direct, positive relationship between EE and behavioral intention to adopt blockchain among respondents, which is consistent with previous research (Davis et al., 1989). This can be explained by different levels of acceptance. The simplicity impression reduces perceived complexity and risks of looking foolish (Davis et al., 1989). At a behavioral level, effort expectancy means less effort to get started, lowering adoption barriers. Lowered effort expectations increase intentions to engage with the technology. Together, this strengthens attitudes towards blockchain. However, this contradicts with Tarhini et al. (2016), who reported difficulty of use was not a major concern. Also, the effect becomes nonsignificant after extended usage (Gupta, Dasgupta & Gupta, 2008) suggesting EE may not be universally significant across contexts and periods.

The findings are consistent with previous research (Shaw, 2014; Duane et al., 2012) that identified TT as a significant factor positively impacting Blockchain adoption. Blockchain requires participants to interact and transact without a central authority, so banks need TT in various aspects to embrace it - namely, that the Blockchain network and recorded data are secure/immutable; actors like developers perform roles responsibly. However, some studies found TT insignificant for adoption (Wong et al., 2020). Their rationale is that most respondents in this survey were uncertain about Blockchain adoption. This lack of awareness among those who recommend or decide on technology purchases hinders the implementation of Blockchain practices. While knowledge boosted TT, overall uncertainty may negate its impact.

The findings relating FC to behavioral intention are consistent with previous research (Venkatesh et al., 2003). FC have a direct positive impact on initial use intentions through reducing risks of using unfamiliar technologies. IT assistance, training materials and documentation increase comfort in trying new technologies. FC also boosts confidence by ensuring effective use capabilities from the start. However, Teo (2010) argued FC alone was insufficient to motivate technology integration by pre-service educators. Simply establishing FC does not guarantee use without considering time expenditure versus traditional methods. While FC retains importance for banks where technology offers unambiguous productivity/profitability advantages, the key drivers fluctuate based on industry context.

The research suggested that a bank's TA negatively influenced their intention to adopt Blockchain. This contradicted previous literature finding TA positively impacted technology use intentions (Wong et al., 2020). Banks with employees that have high TA may underestimate efforts needed for proper pilot initiatives, security concerns, and acceptance across levels. While technology enthusiasm is positive, overconfidence in capabilities may cause risks and challenges to be overlooked or underestimated at scale implementation. Overall, without balancing innovation and oversight, a bank's TA could undermine long-term, well-supported Blockchain adoption plans.

The study found that RS negatively moderates the effect of FC and PE on blockchain adoption by banks. This contrasts with previous research finding regulatory measures positively influence blockchain infrastructure implementation by supporting FC (Wong et al., 2020). It can be explained that in Vietnam's developing regulatory environment for blockchain, lack of clear RS undermines the positive influence of FC on adoption behavior. Without such regulatory certainty, it is challenging for banks to leverage potential FCs for adoption. Hence, while FC remains important, immature RS exacerbates risk perceptions and uncertainty, negatively moderating the influence of enabling conditions on actual behavioral adoption in Vietnam.

The research also found that RS negatively moderates the effect of PE on banks' BA. Vietnam's uncertain regulatory landscape undermines banks' performance expectations and motivation to adopt the technology. The lack of endorsement for Blockchain from regulatory bodies signals it is not a priority, and performance rewards may be limited even if adopted. Ineffective policies and vague legal guidelines inhibit collaboration to effectively address any performance or efficiency issues emerging from Blockchain testing.

The study found that RS positively moderates the effects of TT & TA on banks' BA in Vietnam. Consistent with prior work, TT and RS can mutually reinforce each other (Das & Teng, 1998). Specifically, clear regulatory guidelines, oversight, collaboration and endorsement from regulators help address banks' legal doubts, strengthen belief in blockchain as a trusted solution, and build confidence through transparency of risks. Overall, robust regulatory stewardship in coordination with banks cultivates deeper understanding, transforms initial perceptions into ambitious adoption. While a starting point, more proactive efforts are still needed from the Vietnamese government to fully realize banking sector trust and widespread blockchain adaptation, as described in the study.

RS also enhances the effect of TA on BA. When regulators signal Blockchain is a strategic priority through supportive policies and initiatives, it validates interests of technology-driven banks, giving them confidence to experiment freely. Proactive measures like dedicated sandboxes create protected testing environments, allowing hands-on experience that inspires behavioral changes. Most importantly, robust regulation provides assurances to skeptical stakeholders, empowering bolder cultures to pursue changes aligned with technological progress. In these ways, supportive regulators optimally moderate how intrinsic interests manifest in long-term Blockchain adoption.

6.2 Theoretical contributions

The study confirmed PE, EE, TT and FC positively impact blockchain adoption, consistent with prior work. However, it also identified new impacting factors and moderators. Specifically, TA was found to negatively influence adoption, contrary to previous findings (Wong et al., 2020; Franke et al., 2018). RS was shown to negatively moderate the impact of FC and PE due to Vietnam's evolving regulations, whereas past work found a positive effect (Shi et al.,2018). RS positively moderated the relationships of TT, TA with BA, which prior research had not examined. The model provided new insights into blockchain adoption while confirming prior determinants in the Vietnamese banking context.

The research has covered 3 gaps of previous papers. Firstly, the current research reveals a significant lack of studies investigating Blockchain adoption, particularly in the domains of data management and data transmission. Or else, previous work focused on conceptual frameworks for technical understanding without sufficiently exploring the technical, social and psychological barriers (Christidis & Devetsikiotis, 2016). To address this 2 gap, our study aimed to take a more problem-driven approach by testing potential factors that could hinder or promote Blockchain adoption in data transmission among commercial banks. Secondly, in terms of technology adaptation, TAM and TOE framework have most frequently been used with a small amount of research using UTAUT, ECM, PMT (Alshamsi, Al-Emran, & Shaalan, 2022). Therefore, our research analyzes Blockchain adaptation from a different perspective using modified UTAUT. Finally, Blockchain adaptation research was usually conducted in developing countries, therefore we decided to do research in Vietnam – a developing nation with an incomplete regulatory framework for Blockchain adaptation.

6.3 Managerial contribution

To implement Blockchain into a commercial bank's operation, it is necessary for commercial banks to enhance EE, FC, PE, TT and be cautious about TA. Banks should organize a comprehensive training program that begins with introductory sessions explaining fundamental concepts and hands-on workshops that allow employees to experiment in a low-risk environment. Also, banks should dedicate substantial funding to build out enterprise-grade infrastructure. They must invest in high-availability private networks with scalable servers, redundant storage solutions, and fortified security controls to support emerging Blockchain platforms. Banks should emphasize the tangible benefits this new technology provides from the earliest stages. Moreover, banks need strong security controls on Blockchain platforms to protect sensitive data and transactions. This shows customers their money and information is secure, also, this will be truthful evidence for any partners (other Vietnam commercial banks) during their data transmission. Banks should also pursue industry certifications that prove they follow best practices and regulations since getting certified reassures customers and regulators that banks are compliant. Another recommendation is that banks should conduct comprehensive readiness assessments involving all business units to foster wider understanding and buy-in for strategic roadmaps. Additionally, banks need to educate stakeholders on both Blockchain opportunities and limitations to set realistic expectations.

In terms of regulation, the government must ensure regulatory requirements do not unintentionally drain banks' resources or lower performance expectations. When rules make compliance too expensive, it takes away resources banks need for Blockchain investments. To leverage the positive moderation, governments could establish regulatory sandboxes and guidance specific to innovative Blockchain analytics solutions. This gives banks structured yet flexible environments to experiment and gain experience applying Blockchain analytics under regulatory oversight.

7. LIMITATIONS AND CONCLUSION

Our research was to collect data through questionnaires survey, which is not enough to explain the interrelationships among the factors affecting the adoption of Blockchain. Relying solely on questionnaires has significant shortcomings in elucidating the interrelationships among adoption factors. Also our research concentrated on measuring Blockchain adoption without focusing on the acceptance and continuous intention perspectives. Focusing exclusively on initial adoption provides an incomplete picture as it overlooks key subsequent stages in Blockchain's life cycle within organizations. Finally, the research was confined to studying factors impacting Blockchain adoption among Vietnamese banks only. Vietnam remains a developing nation without mature regulatory oversight and technology infrastructure comparable to more advanced economies. These contextual limitations have implications for generalizing the findings on a global scale.

The main objective of this research was to empirically investigate the key factors impacting acceptance and application of Blockchain for data transfers among Vietnamese commercial banks. We sought to answer three research questions. First, we assessed the current development stage of Blockchain in Vietnam, finding it is still nascent, presenting both opportunities and challenges for banks and firms to leverage this innovative technology. Second, we identified the crucial elements influencing Blockchain adoption amongst Vietnamese commercial banks, providing guidance on adapting Blockchain into their processes. Third, we recommended next steps for banks and regulators based on our findings using the UTAUT model to determine adoption drivers. However, further exploration is still needed. Research into other domains like energy (Ullah, Alnumay, Al-Rahmi), shipping (Yang, 2019) and tourism (Nuryyev et al., 2020) could uncover unique factors influencing different sectors. Longitudinal studies observing attitudes across the technology lifecycle would offer a deeper perspective. Financial considerations and mixed qualitative methods like interviews could provide additional contextual understanding left out of our questionnaire. Finally, broader international surveys may reveal cultural and national nuances in Blockchain acceptance not found within Vietnam alone.

REFERENCE

Alraja, M. N. (2015). "User Acceptance of Information Technology: A Field Study of an E-Mail System Adoption from the Individual Students' Perspective", *Mediterranean Journal of Social Sciences*.

AlAwadhi, S. & Morris, A. (2008). "The Use of the UTAUT Model in the Adoption of E-Government Services in Kuwait", *IEEE*.

Alazab, M., Alhyari, S., Awajan, A. & Abdallah, A. B. (2020). "Blockchain technology in supply chain management: an empirical study of the factors affecting user adoption/acceptance", *Cluster Computing*, Vol. 24 No. 1, pp. 83–101.

Alshamsi, M., Al-Emran, M. & Shaalan, K. (2022). "A Systematic Review on blockchain adoption", *Applied Sciences*, Vol. 12 No. 9, p. 4245.

Arantes, G. M., D'Almeida, J. N., Onodera, M. T., De Borba Maranhao Moreno, S. M. & Da Rocha Santos Almeida, V. (2018). "Improving the process of lending, monitoring and evaluating through blockchain technologies: an application of blockchain in the Brazilian Development Bank (BNDES)", *IEEE*.

Azaria, A., Ekblaw, A., Vieira, T. A. & Lippman, A. (2016). "MedRec: Using Blockchain for Medical Data Access and Permission Management", *IEEE Xplore*.

Bagozzi, R. P. & Yi, Y. (1988). "On the evaluation of structural equation models", *Journal of the Academy of Marketing Science*, Vol. 16 No. 1, pp. 74–94.

Balasubramanian, S., Shukla, V., Sethi, J. S., Islam, N. & Saloum, R. (2021). "A readiness assessment framework for Blockchain adoption: A healthcare case study", *Technological Forecasting and Social Change*, Vol. 165, p. 120536.

Bansod, S. & Ragha, L. (2020). "Blockchain Technology: applications and research challenges", *2020 International Conference for Emerging Technology (INCET)*.

Birch, A. & Irvine, V. (2009). "Preservice teachers' acceptance of ICT integration in the classroom: applying the UTAUT model", *Educational Media International*, Vol. 46 No. 4, pp. 295–315.

Building the hyperconnected future on blockchain. (2017). "*European Commission Joint Research Centre (JRC)*", Available at: http://internetofagreements.com/files/WorldGovernmentSummit-Dubai2017.pdf

Cocco, L., Pinna, A. & Marchesi, M. (2017). "Banking on Blockchain: Costs savings thanks to the blockchain technology", *Future Internet*, Vol. 9 No. 3, p. 25.

Chao, C. (2019). "Factors determining the behavioral intention to use Mobile Learning: an application and extension of the UTAUT model", *Frontiers in Psychology*, Vol. 10.

Chang, I., Hwang, H., Hung, W. & Li, Y. (2007). "Physicians' acceptance of pharmacokinetics-based clinical decision support systems", *Expert Systems With Applications*, Vol. 33 No. 2, pp. 296–303.

Christidis, K. & Devetsikiotis, M. (2016). "Blockchains and smart contracts for the internet of things", *IEEE Access*, Vol. 4, pp. 2292–2303.

Chowdhury, M. U., Suchana, K., Alam, S. M. E. & Khan, M. M. (2021). "Blockchain application in banking system", *Journal of Software Engineering and Applications*, Vol. 14 No. 07, pp. 298–311.

Chuah, S. H., Marimuthu, M., Kandampully, J. & Bilgihan, A. (2017). "What drives Gen Y loyalty? Understanding the mediated moderating roles of switching costs and alternative attractiveness in the value-satisfaction-loyalty chain", *Journal of Retailing and Consumer Services*, Vol. 36, pp. 124–136.

Das, T. & Teng, B. (1998). "Between trust and control: Developing confidence in partner cooperation in alliances", *Academy of Management Review*, Vol. 23 No. 3, p. 491.

Davis, F. D. (1989). "Perceived usefulness, perceived ease of use, and user acceptance of information technology", *Management Information Systems Quarterly*, Vol. 13 No. 3, p. 319.

Duane, A., O'Reilly, P. & Andreev, P. A. (2012). "Realising M-Payments: modelling consumers' willingness to M-pay using Smart Phones", *Behaviour & Information Technology*, Vol. 33 No. 4, pp. 318–334.

Fornell, C. & Larcker, D. F. (1981). "Evaluating Structural Equation Models with Unobservable Variables and Measurement Error", *Journal of Marketing Research*, Vol. 18 No. 1, p. 39.

Franke, T., Attig, C. & Wessel, D. (2019). "A Personal Resource for Technology interaction: Development and Validation of the Affinity for Technology Interaction (ATI) scale", *International Journal of Human-Computer Interaction*, Vol. 35 No. 6, pp. 456–467.

Gefen, D., Karahanna, E. & Straub, D. W. (2003). "Trust and TAM in online shopping: an integrated model", *Management Information Systems Quarterly*, Vol. 27 No. 1, p. 51.

Geisser, S. (1974). "A predictive approach to the random effect model", *Biometrika*, Vol. 61 No. 1, p. 101.

Guo, Y. & Liang, C. (2016). "Blockchain application and outlook in the banking industry", *Financial Innovation*, Vol. 2 No. 1.

Gupta, B., Dasgupta, S. & Gupta, A. (2008). "Adoption of ICT in a government organization in a developing country: An empirical study", *The Journal of Strategic Information Systems*, Vol. 17 No. 2, pp. 140–154.

Gupta, K. P., Manrai, R. & Goel, U. (2019). "Factors influencing adoption of payments banks by Indian customers: extending UTAUT with perceived credibility", *Journal of Asia Business Studies*, Vol. 13 No. 2, pp. 173–195.

Hair, J. F., Ringle, C. M. & Sarstedt, M. (2011a). "PLS-SEM: indeed a silver bullet", *Journal of Marketing Theory and Practice*, Vol. 19 No. 2, pp. 139–152.

Hughes, D. L., Dwivedi, Y. K., Misra, S. K., Rana, N. P., Raghavan, V. & Akella, V. (2019). "Blockchain research, practice and policy: Applications, benefits, limitations, emerging research themes and research agenda", *International Journal of Information Management*, Vol. 49, pp. 114–129.

Hoy, M. B. (2017). "An introduction to the blockchain and its implications for libraries and medicine", *Medical Reference Services Quarterly*, Vol. 36 No. 3, pp. 273–279.

Jaafar, M., Aziz, A. R. A., Ramayah, T. & Saad, B. (2007). "Integrating information technology in the construction industry: Technology readiness assessment of Malaysian contractors", *International Journal of Project Management*, Vol. 25 No. 2, pp. 115–120.

Kamble, S. S., Gunasekaran, A. & Arha, H. (2018). "Understanding the Blockchain technology adoption in supply chains-Indian context", *International Journal of Production Research*, Vol. 57 No. 7, pp. 2009–2033.

Kar, A. K. & Navin, L. (2021). "Diffusion of blockchain in insurance industry: An analysis through the review of academic and trade literature", *Telematics and Informatics*, Vol. 58, p. 101532.

Kshetri, N. (2018). "1 Blockchain's roles in meeting key supply chain management objectives", *International Journal of Information Management*, Vol. 39, pp. 80–89.

Lallmahomed, M. Z. I., Rahim, N. Z. A., Ibrahim, R. & Rahman, A. A. (2013). "Predicting different conceptualizations of system use: Acceptance in hedonic volitional context (Facebook)", *Computers in Human Behavior*, Vol. 29 No. 6, pp. 2776–2787.

Liao, C., Palvia, P. & Lin, H. (2006). "The roles of habit and web site quality in e-commerce", *International Journal of Information Management*, Vol. 26 No. 6, pp. 469–483.

Lu, Q. & Xu, X. (2017). "Adaptable Blockchain-Based Systems: A case study for product traceability", *IEEE Software*, Vol. 34 No. 6, pp. 21–27.

Martino, P. (2019). "Blockchain technology: Challenges and opportunities for banks", *International Journal of Financial Innovation in Banking*, Vol. 1 No. 1, p. 1.

Mikroyannidis, A., Domingue, J., Bachler, M. & Quick, K. (2018). "A Learner-Centred approach for lifelong learning powered by the blockchain", Available at: https://www.learntechlib.org/p/184356/

Mendling, J., Weber, I., Van Der Aalst, W. M. P., Brocke, J. V., Cabanillas, C., Daniel, F. & Zhu, L. (2018). "Blockchains for Business Process Management - Challenges and opportunities", *ACM Transactions on Management Information Systems*, Vol. 9 No. 1, pp. 1–16.

Nair, R., Nasrullah, S., Vinayasree, P., Singh, P., Zahra, M. M. A., Sharma, T. & Ahmadi, F. (2022). "Blockchain-Based decentralized cloud solutions for data transfer", *Computational Intelligence and Neuroscience*, Vol. 2022, pp. 1–12.

Nguyen, Q. K. (2016). "Blockchain - A Financial Technology for Future Sustainable Development", *IEEE Xplore*.

Neisse, R., Steri, G. & Nai-Fovino, I. (2017). "A blockchain-based approach for data accountability and provenance tracking", *European Commission Joint Research Centre (JRC)*.

Nugroho, M. A., Susilo, A. Z., Fajar, M. A. & Rahmawati, D. (2017). "Exploratory study of SMEs Technology Adoption Readiness Factors", *Procedia Computer Science*, Vol. 124, pp. 329–336.

Nuryyev, G., Wang, Y. P., Achyldurdyyeva, J., Jaw, B. S., Yeh, Y. S., Lin, H. H. & Wu, L. (2020). "Blockchain Technology Adoption Behavior and Sustainability of the Business in Tourism and Hospitality SMES: An Empirical study", *Sustainability (Basel)*, Vol. 12 No. 3, p. 1256.

Patki, A. & Sople, V. (2020). "Indian banking sector: blockchain implementation, challenges and way forward", *Journal of Banking and Financial Technology*, Vol. 4 No. 1, pp. 65–73.

Pham, D. K. (2022). "Digital Banking adoption in Vietnam: an application of UTAUT2 model", *Webology*, Vol. 19 No. 1, pp. 3243–3262.

Queiroz, M. M., Wamba, S. F., De Bourmont, M. & Telles, R. (2020). "Blockchain adoption in operations and supply chain management: empirical evidence from an emerging economy", *International Journal of Production Research*, Vol. 59 No. 20, pp. 6087–6103.

Saberi, S., Kouhizadeh, M., Sarkis, J. & Shen, L. Y. (2018). “Blockchain technology and its relationships to sustainable supply chain management”, *International Journal of Production Research*, Vol. 57 No. 7, pp. 2117–2135.

Sharples, M. & Domingue, J. (2016). “The blockchain and Kudos: a distributed system for educational record, reputation and reward”, *Lecture Notes in Computer Science*, pp. 490–496.

Shaw, N. (2014). “The mediating influence of trust in the adoption of the mobile wallet”, *Journal of Retailing and Consumer Services*, Vol. 21 No. 4, pp. 449–459.

Shi, G. V., Baldwin, J., Koh, S. L. & Choi, T. Y. (2017). “Fragmented institutional fields and their impact on manufacturing environmental practices”, *International Journal of Production Research*, Vol. 56 No. 1–2, pp. 431–446.

Skiba, D. J. (2017). “The potential of blockchain in education and health care”, *Nursing Education Perspectives*, Vol. 38 No. 4, pp. 220–221.

Singh, S. & Singh, N. (2016). “Blockchain: Future of financial and cyber security”, *IEEE Xplore*.

Sutton, A. & Samavi, R. (2017). “Blockchain enabled Privacy Audit logs”, *Lecture Notes in Computer Science*, pp. 645–660.

Tan, G. W. & Ooi, K. (2018). “Gender and age: Do they really moderate mobile tourism shopping behavior?”, *Telematics and Informatics*, Vol. 35 No. 6, pp. 1617–1642.

Teo, A., Tan, G. W., Ooi, K., Hew, T. & Yew, K. (2015). “The effects of convenience and speed in m-payment”, *Industrial Management and Data Systems*, Vol. 115 No. 2, pp. 311–331.

Teo, A., Tan, G. W., Ooi, K. & Lin, B. (2015). “Why consumers adopt mobile payment? A partial least squares structural equation modelling (PLS-SEM) approach”, *International Journal of Mobile Communications*, Vol. 13 No. 5, pp. 478.

Teo, T. (2010). “Examining the influence of subjective norm and facilitating conditions on the intention to use technology among pre-service teachers: a structural equation modeling of an extended technology acceptance model”, *Asia Pacific Education Review*, Vol. 11 No. 2, pp. 253–262.

Tomatzky, L. G. & Fleischer, M. (1990). *The processes of technological innovation Lexington Books.* Lexington MA.

Ullah, N., Alnumay, W. S., Al-Rahmi, W. M., Alzahrani, A. I. & Al-Samarraie, H. (2020). “Modeling cost saving and innovativeness for blockchain technology adoption by energy management”, *Energies*, Vol. 13 No. 18, p. 4783.

Vatanasombut, B., Igbaria, M., Stylianou, A. C. & Rodgers, W. (2008). “Information systems continuance intention of web-based applications customers: The case of online banking”, *Information & Management*, Vol. 45 No. 7, pp. 419–428.

Venkatesh, V., Morris, M., Davis, G. B. & Davis, F. D. (2003). “User acceptance of information Technology: toward a unified view”, *Management Information Systems Quarterly*, Vol. 27 No. 3, p. 425.

Venkatesh, V., Thong, J. Y. & Xu, X. (2012). "Consumer Acceptance and use of Information technology: Extending the unified theory of acceptance and use of technology", *Management Information Systems Quarterly*, Vol. 36 No. 1, p. 157.

Wong, C., Tan, G. W., Loke, S. & Ooi, K. (2015). "Adoption of mobile social networking sites for learning?", *Online Information Review*, Vol. 39 No. 6, pp. 762–778.

Wong, L., Leong, L., Hew, J., Tan, G. W. & Ooi, K. (2020). "Time to seize the digital evolution: Adoption of blockchain in operations and supply chain management among Malaysian SMEs", *International Journal of Information Management*, Vol. 52, p. 101997.

Wong, L., Tan, G. W., Lee, V., Ooi, K. & Sohal, A. S. (2020). "Unearthing the determinants of Blockchain adoption in supply chain management", *International Journal of Production Research*, Vol. 58 No. 7, pp. 2100–2123.

Wu, B. & Duan, T. (2019b). "The Application of Blockchain Technology in Financial markets", *Journal of Physics: Conference Series*, Vol. 1176, p. 042094.

Wu, B. & Duan, T. (2019a). "The Advantages of Blockchain Technology in Commercial Bank Operation and Management", *ResearchGate*.

Yaga, D. J., Mell, P., Roby, N. & Scarfone, K. (2018). "Blockchain technology overview".

Yamane (1967). *Statistics, An Introductory Analysis*, New York : Harper and Row

Yang, C., Chen, X. & Xiang, Y. (2018). "Blockchain-based publicly verifiable data deletion scheme for cloud storage", *Journal of Network and Computer Applications*, Vol. 103, pp. 185–193.

Yang, C. (2019). "Maritime shipping digitalization: Blockchain-based technology applications, future improvements, and intention to use", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 131, pp. 108–117.

Yli-Huumo, J., Ko, D., Choi, S., Park, S. & Smolander, K. (2016). "Where is current research on blockchain Technology?—A systematic review", *PLOS ONE*, Vol. 11 No. 10, p. 0163477.

Yousafzai, S. & Yani-De-Soriano, M. M. (2012). "Understanding customer-specific factors underpinning internet banking adoption", *International Journal of Bank Marketing*, Vol. 30 No. 1, pp. 60–81.

Zheng, X. R. & Lu, Y. (2021). "Blockchain technology – recent research and future trend", *Enterprise Information Systems*, Vol. 16 No. 12.

Zheng, Z., Xie, S., Dai, H., Chen, X. & Wang, H. (2017). "An overview of blockchain technology: architecture, consensus, and future trends", *IEEE International Congress on Big Data (BigData Congress)*, pp. 557–564.

Zhou, T., Lu, Y. & Wang, B. (2010). "Integrating TTF and UTAUT to explain mobile banking user adoption", *Computers in Human Behavior*, Vol. 26 No. 4, pp. 760–767.

Zhu, K., Kraemer, K. L. & Xu, S. X. (2006). “The process of innovation assimilation by firms in different countries: A Technology Diffusion Perspective on E-Business”, *Management Science*, Vol. 52 No. 10, pp. 1557–1576.

Zou, J., Ye, B., Qu, L., Orgun, M. A. & Li, L. (2019). “A Proof-of-Trust consensus protocol for enhancing accountability in crowdsourcing services”, *IEEE Transactions on Services Computing*, Vol. 12 No. 3, pp. 429–445.

Zyskind, G., Nathan, O. & Pentland, A. (2015). “Decentralizing Privacy: Using Blockchain to Protect Personal Data”, *IEEE Xplore*.