

Factors Affecting Blockchain Technology Acceptance: An Empirical Study

Meiling Zeng¹
Fuyume Sai^{2,*}

*Corresponding author

¹ Graduate School of Business Administration, Doctoral Student, Daito Bunka University, Tokyo, Japan

² Graduate School of Business Administration, Professor, Daito Bunka University, Tokyo, Japan, fuyume-sai@ic.daito.ac.jp

ABSTRACT

The primary goal of the present study is to provide a model for investigating consumer-related factors influencing blockchain acceptance in the context of voluntary use. In addition to the constructs of the technology acceptance model (TAM), three predictor constructs were proposed: subjective norm retained from the theory of reasoned action (TRA), compatibility drawn from the diffusion of innovation theory (DOI), and innovativeness taken from the technology readiness index (TRI). The model constructs were measured using the items validated previously in relevant literature and a five-point disagree-agree scale. Based on 169 valid online survey data collected from China, the results of PLS-SEM analysis showed that the basic TAM relationships (i.e., usefulness-intention and ease of use-intention) were well supported, whereas perceived ease of use was not associated with perceived usefulness significantly. Among the predictors, subjective norm was found to have no significant effect on perceived usefulness and intention to use, and the compatibility-intention and innovativeness-intention relationships were nonsignificant as well. However, both compatibility and innovativeness showed positive impacts on consumer intention to use blockchain, mediated by perceived usefulness and ease of use. Additionally, some discussions and suggestions are provided at the end.

Keywords: Technology acceptance model, diffusion of innovation, technology readiness index, theory of reasoned behavior, blockchain, consumer behavior, PLS-SEM.

INTRODUCTION

Since blockchain was first conceptualized in a peer-to-peer electronic cash system in 2008 (Nakamoto, 2008), blockchain technology has gained considerable recognition around the world (Emna et al., 2021; Grover et al., 2019; Vida et al., 2019; Yanling et al., 2021). According to a survey by Statista, global spending on blockchain solutions will reach about \$18.95 billion by 2024. As a digital mechanism that combines existing technologies and techniques into a novel architecture to create a distributed digital ledger (Nakamoto, 2008), organizations have increasingly applied blockchain technology due to the benefits such as cost optimization, immutable record keeping, transparency, route tracking, and so on (Ahmad et al., 2022; Felin & Lakhani, 2018; Joe & Raafat, 2021; Lacity, 2018; Zaina et al., 2020).

In recent years, many studies have explored blockchain adoption in various fields in digital currency, supply chain and logistics, e-commerce, online education, corporate government (Anushree et al., 2022; Joe & Raafat, 2021), revealing that blockchain application can effectively boost customer trust (Tedjo et al., 2022; Geetika et al., 2020; Nishant et al., 2022; Shrestha & Vassileva, 2019), improve the efficiency of supply chain management process with lower cost (Bhardwaj et al., 2021; Kshetri, 2017; Queiroz & Fosso, 2019), and can support logistics services, making services faster and smarter (Lian et al., 2020), for example, blockchain-based self-service by which logistics personnel /online shoppers can deliver or pickup goods by themselves as needed without limitation in time or location (Tedjo et al., 2022). On the other hand, it is also seen that many people have great hesitancy about adopting blockchain, and they are reluctant to be pioneers because of the gap existing between perceived and actual business value (Felin & Lakhani, 2018; Lacity, 2018).

Regarding consumers' blockchain acceptance behavior, in comparison with the studies in terms of organizational technology adoption, it is pointed out that empirical research on consumers' blockchain acceptance is lacking (Tandon et al., 2021). Therefore, this study aims to investigate blockchain acceptance behavior, focusing on the factors affecting consumer intention to use blockchain technology.

To this end, we first go with the traditional theories of technology acceptance and incorporate two theoretical constructs: innovativeness, defined as the tendency to be a technology pioneer and thought leader from the Technology Readiness Index (TRI) (Parasuraman, 2000), and compatibility, defined as the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters from the Diffusion of Innovation theory (DOI) (Rogers, 2003). Next, the relationships proposed in the model are studied empirically. And a discussion is conducted at the end.

THEORETICAL BACKGROUND

Theory of reasoned action (TRA) is a general theory of human behavior (Fishbein, 1967), theorizing that an individual's intention

to perform a given behavior is an immediate causal determinant of the behavioral performance and that an individual's intention is jointly determined by his or her attitude toward performing the behavior as well as the perceived social influence of people who are important to the individual (Fishbein & Ajzen, 1975; Davis, 1989), as described in the following:

$$\text{Behavior} \sim \text{Behavioral Intention} = w_1 * \text{Attitude} + w_2 * \text{Social Norm}$$

where the weights (w_1 , w_2) reflect the relative causal influence of the factors in a given situation. Based on the TRA, the theory of planned behavior (TPB) adds a perceived behavioral control construct derived from self-efficacy theory (Bandura, 1977). This construct represents the perception of the difficulty of performing a given behavior, and control beliefs generate self-efficacy, which plays a corresponding regulatory role (Ajzen, 1985).

Also drawing upon TRA, the technology acceptance model (TAM) introduces two beliefs (i.e., perceived usefulness and perceived ease of use) to characterize the basic mechanism of users' acceptance of information technology and systems (Davis, 1989; Natalia, 2021), hypothesizing that intentions to use a technology determine usage behavior, and perceived usefulness and perceived ease of use determine intentions to use technology. The former linkage makes TAM overlap with the TRA and the TPB, and the latter linkages replace the effects of attitudes and social norms under the TRA and the effects of attitudes, social norms, and perceived behavioral control under the TPB. Since its first publication (Davis, 1989), TAM has become one of the most effective methods for modelling technology acceptance and explaining how users come to accept and apply technology (Natalia, 2021). Figure 1 shows the final version of TAM (Venkatesh & Davis, 1996), where external variables include "system characteristics, training, user involvement in design, and the nature of the implementation process." Perceived usefulness refers to "the degree to which a person believes that using a particular system would enhance his or her job performance"; Perceived ease of use refers to "the degree to which a person believes that using a particular system would be free from effort."

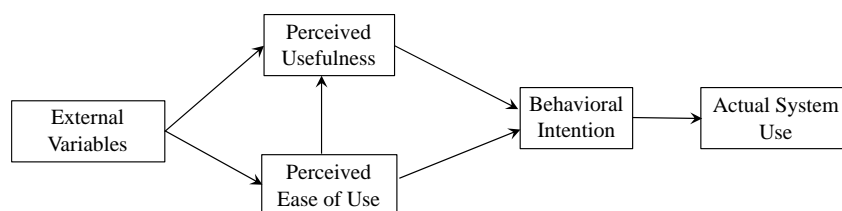


Figure 1: The final version of Technology Acceptance Model (Venkatesh & Davis, 1996)

Diffusion of Innovation Theory (Rogers, 1962) provides a framework for understanding the mode, reason, and rate at which innovations spread in a social system. Innovation is referred to as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption." Rogers (2003) proposes that attributes of innovations that may influence individuals to accept or reject the innovation include five characteristics of innovations: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability. And he reported that 49-87% of the variance in the rate of adoption of innovations is explained by the five attributes. In their meta-analysis, Tornatzky & Klein (1982) find that relative advantage (the degree to which an innovation is perceived as being better than the idea it supersedes (Rogers, 2003, p. 229) and compatibility (the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters (Rogers, 2003, p.15) were positively related to user acceptance ($p < 0.05$) and complexity (the degree to which an innovation is perceived as relatively difficult to understand and use (Rogers, 2003, p.15) was negatively related to adoption but did not reach the acceptable level of statistical significance ($p = 0.062$). In terms of technology acceptance, although it needs to be open to question, previous studies treat relative advantage as perceived usefulness (e.g., Moore and Benbasat, 1991; Adams et al., 1992; Plouffe et al., 2001). And Davis (1989) also points out that "complexity parallels perceived ease of use quite closely."

Technology readiness index (TRI) is a multiple-item scale to assess people's technology readiness, referred to as "people's propensity to embrace and use new technologies for accomplishing goals in home life and at work" (Parasuraman, 2000). It is a four-dimensional construct comprising two drivers (optimism and innovativeness) and two inhibitors (discomfort and insecurity) for measuring beliefs an individual has about technology-based products and services in general. As the positive factor affecting technology adoption, optimism refers to a positive view of technology and a belief that it offers people increased control, flexibility, and efficiency, and innovativeness is defined as the tendency to be a technology pioneer and thought leader (Parasuraman, 2000).

HYPOTHESES AND THEORETICAL MODEL

Several studies have repeatedly validated the effect of TAM's constructs on blockchain adoption. In studying consumers' Bitcoin acceptance behavior, Folkinshteyn & Lennon (2016) pointed out that perceived usefulness and perceived ease of use have a significant positive effect on Bitcoin adoption. Based on TAM and 254 valid responses, Liu & Ye (2021) investigated the determinants of blockchain adoption from the consumer's perspective and verified the positive effects of perceived usefulness and perceived ease of use on the users' intention to utilize blockchain technology. In a systematic review involving 39 empirical studies that focus on the factors affecting blockchain adoption, Marengo & Pagano (2023) revealed that in addition to users' skill and knowledge to use blockchain, perceived usefulness and perceived ease of use are the most common user-related factors among the identified 152 factors that influence user acceptance and are universally relevant to blockchain adoption across 21 countries and 25 industries (e.g., supply chain, logistics, taxing system, education, tourism, crowdsourcing platform, and others). So, based on TAM, we postulate the following hypotheses:

- H1 Perceived usefulness has a positive effect on users' intention to use blockchain technology.*
H2 Perceived ease of use has a positive effect on users' intention to use blockchain technology.
H3 Perceived ease of use has a positive effect on perceived usefulness of blockchain technology.

Previous studies have also shown that perceived social influence affects users' blockchain acceptance. For example, Kamble et al. (2019) conducted a survey of 181 Indian supply chain practitioners, showing that subjective norms positively influence users' perceived usefulness of blockchain technology. Nuryyev et al. (2020) investigated the factors affecting cryptocurrency adoption in the tourism and hospitality industries, reporting that perceived usefulness mediates the effect of subjective influence on behavioral intention, and social influence also positively affects the intention to use cryptocurrency. Thus, we propose the following hypotheses:

- H4 Subjective norm have a positive effect on perceived usefulness of blockchain technology.*
H5 Subjective norm have a positive effect on users' intention to use blockchain technology.

Also, existing studies have examined the effect of compatibility in blockchain acceptance research. For example, in studying blockchain adoption behavior in supply chain management, Bhardwaj et al. (2021) analyzed 216 data from small and medium-sized enterprises, revealing that compatibility ($\beta = 0.381, p < 0.001$) and relative advantages ($\beta = 0.294, p < 0.001$) positively affect users' intentions to utilize blockchain. Nazir et al. (2021) conducted a survey on the adoption of blockchain applications in smart learning environments and collected 198 valid responses from experts in education. In the study, they defined compatibility as the extent to which the innovation is viewed as consistent with the end-users' beliefs, expectations, and requirements. The results showed that compatibility has a positive effect on perceived usefulness ($\beta = 0.326, p < 0.001$), perceived ease of use ($\beta = 0.275, p < 0.001$), and users' behavioral intention to use the application ($\beta = 0.226, p < 0.01$). Accordingly, we suggest the following hypotheses:

- H6 Compatibility affects perceived usefulness of blockchain technology positively.*
H7 Compatibility affects perceived ease of use of blockchain technology positively.
H8 Compatibility affects intention to use blockchain technology positively.

Innovativeness in TRI, referred to as an individual tendency to be a technology pioneer and thought leader, is one of the often-examined constructs in previous empirical research on the acceptance behavior of innovative products and services (Wood & Swait, 2002). Also, as in studying blockchain adoption behavior, to understand various decision-making factors that affect the adoption of blockchain technology in supply chains, Kamble et al. (2019) adopted a three-structure integration built on TAM, TRI, and TPB. They pointed out that TRI factors did not affect blockchain adoption behavior in supply chains, which may be related to the survey respondents' experience and expertise with or familiarity with blockchain or other related technologies. Nazir (2020) also introduced optimism and innovativeness of TRI as TAM's antecedents when examining user acceptance of blockchain in Pakistan's service and manufacturing industries; however, the findings showed that both optimism and innovativeness had no significant effect on perceived usefulness but had a significant positive effect on perceived ease of use. Nazir et al. (2020) also indicate that the influencing factors vary in technology application areas; for instance, in the supply chain area, as early adopter of blockchain technology, it is suggested that there is no need to consider whether the technology can achieve users' goals because the users already have relevant knowledge or use experience. Ammar et al. (2023) analyzed 251 survey responses from Malaysian software industry professionals, resulting in the finding that innovativeness has a positive effect on the intention to adopt blockchain technology ($\beta = 0.11, p < 0.001$). Therefore, in line with the existing studies, we propose the following hypotheses:

- H9 Innovativeness affects perceived usefulness of blockchain technology positively.*
H10 Innovativeness affects perceived ease of use of blockchain technology positively.
H11 Innovativeness affects intention to use blockchain technology positively.

Figure 2 depicts the model based on TRA and TAM and incorporates two constructs (compatibility and innovativeness) as antecedents in this study.

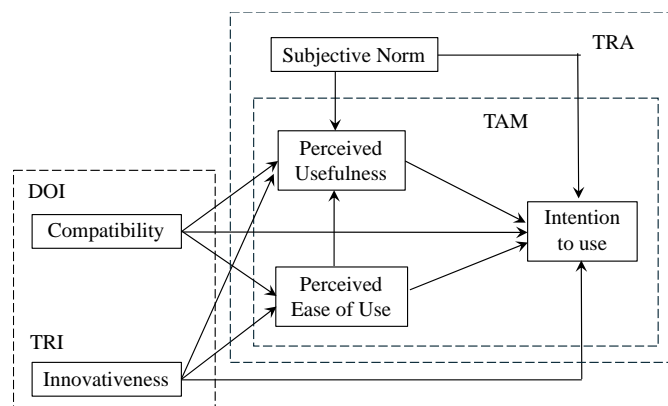


Figure 2: The theoretical model for this study

METHODOLOGY

As shown in Figure 2, the model proposed consists of six constructs. All items in each construct use a five-point disagree-agree scale and are taken from previously validated relevant literature. Three items for perceived usefulness and three items for intention to use are from Davis et al. (1989) and Yu et al. (2021). Four items for perceived ease of use are drawn from Davis et al. (1989) and Bhardwaj et al. (2021). Three items for subjective norm are from Davis et al. (1989) and Venkatesh et al. (2003). Four items for compatibility are taken from Wang et al. (2022) and Moore et al. (1991). And among five items for innovativeness, two items are from Agarwal & Prasad (1998) and Davit et al. (2022), and three are drawn from Parasuraman (2000) and Nuryyev et al. (2020).

Data Collection

The data was collected through a one-month online survey starting on 2023 December. 6. 245 responses from China were obtained. Of which, 76 were excluded due to incomplete answers, missing questions, or abnormal response time. In total, there are 169 valid data (50 males and 119 females; age <25: 82, 25-35: 70, 36-50: 16, >50: 1; diploma/lower: 3, bachelor: 79, postgraduate/higher: 87). Among them, 96 (56.8%) have experience using blockchain applications. And 51 (only heard of), 40 (know), and 4 (know very well) responded to the question "Do you know about blockchain technology?". Overall, the respondents to this study are relatively young, with a bachelor's or higher degree, and most of them are not familiar with blockchain technology.

Reliability, Convergent Validity and Discriminant Validity

This study proceeds based on PLS-SEM to confirm the reliability and validity on both an indicator and a construct level by measures of indicator loading (IL), Cronbach's alpha, composite reliability (CR), reliability coefficient rhoA, and average variance extracted (AVE) (Hair et al., 2017). Following Henseler et al (2015), heterotrait-monotrait ratio (HTMT) is used to ensure the extent to which one construct is empirically distinct from others in the proposed model. Table 1 presents the measurement results obtained by running R (ver. 4.4.0) and the assessing criteria for each measure.

Table 1: Evaluation of the reliability and validity

Construct	IL	Reliability and Convergent validity				Discriminant validity using HTMT				
		Cronbach's alpha	rhoA	CR	AVE	SN	COM	INNO	PEOU	PU
SN	0.761-0.856	0.710	0.717	0.838	0.633					
COM	0.796-0.871	0.854	0.861	0.902	0.696	0.685				
INNO	0.686-0.827	0.801	0.810	0.862	0.556	0.562	0.671			
PU	0.885-0.933	0.899	0.842	0.937	0.832	0.416	0.598	0.577		
PEOU	0.768-0.852	0.814	0.905	0.876	0.639	0.457	0.715	0.656	0.521	
ITU	0.861-0.863	0.830	0.835	0.898	0.746	0.461	0.618	0.564	0.588	0.667

SN: Social norm; COM: Compatibility; INNO: Innovativeness; PU: Perceived usefulness; PEOU: Perceived ease of use; ITU: Intention to use; IL: Indicator loading;

CR: Composite reliability; AVE: Average variance extracted; HTMT: Heterotrait-monotrait ratio.

Criteria -- FL: higher than 0.708; Cronbach's alpha, rhoA and CR exceed 0.70; rhoA: between Cronbach's alpha and CR; AVE: higher than 0.50; HTMT: lower than 0.85.

As shown in Table 1, all indicator loadings of the corresponding measured constructs are higher than the threshold value of 0.708 (Hair et al., 2019), except one in innovativeness, which is 0.686. The indicator is retained as the Cronbach's alpha, CR, and AVE of innovativeness met the required thresholds of 0.70 and 0.50 (Hair et al., 2017a). Calculated by running the bootstrapping routine, the HTMT values of all the constructs are lower than 0.85. As such, it suggests that discriminant validity across constructs is supported (Henseler et al., 2015).

Assessment of Structural Model

In terms of collinearity issues, as shown in Table 2, the variance inflation factor (VIF) values of predictor constructs (i.e., SN, COM, INNO, PU, PEOU) in relation to each endogenous construct (i.e., PU, PEOU, ITU) are all below the threshold of 3, suggesting that collinearity among the five predictor constructors is not a concern in the structural model (Hair et al., 2017). Next, considering the model's explanatory power, the R-squared (R^2) values of the three endogenous constructs are examined, resulting in 47.4% of the variance in perceived usefulness ($R^2 = 0.474$) being explained by the predictor constructs of compatibility, innovativeness, social norm, and perceived ease of use, whereas consumers' compatibility and innovativeness explained 31.5% of the variance in perceived ease of use ($R^2 = 0.315$) and 43.3% of the variance in consumer intention to use blockchain technology ($R^2 = 0.433$) was explained by all five predictor constructs. And regarding the predictive power of the structural model, the out-of-sample predictive error is assessed by using root-mean-squared error (RMSE) and mean absolute error (MAE). As can be seen in Table 3, the PLS-SEM model has lower values compared to the values of the linear regression model (LM) for all the indicators in terms of RMSE and MAE. Thus, we conclude that the model proposed has high predictive power.

Table 2: Predictors' VIF values

Table 3: The results of PLSpredict procedure

	PU	PEOU	ITU			PU_1	PU_2	PU_3	PEOU_1	PEOU_2	PEOU_3	PEOU_4	ITU_1	ITU_2	ITU_3
SN	1.458		1.459	RMSE	PLS	0.510	0.503	0.551	0.651	0.671	0.706	0.632	0.495	0.532	0.522
COM	1.951	1.504	2.270		LM	0.526	0.528	0.552	0.702	0.716	0.742	0.659	0.524	0.568	0.559
INNO	1.659	1.504	1.901	MAE	PLS	0.402	0.391	0.417	0.523	0.528	0.544	0.484	0.371	0.407	0.401
PU			1.828		LM	0.394	0.407	0.419	0.556	0.564	0.575	0.488	0.395	0.417	0.420
PEOU	1.460		1.486												

Hypothesis Testing and Mediation effects

In this step, the relevance and significance of the structural paths were examined. Table 4 and Figure 3 show the results of hypothesis testing by bootstrapping (5000 samples). As the 95% confidence intervals include zero, social norm, compatibility, and innovativeness have no significant effect on intention to use (H5: $\beta = 0.072$, $p = 0.358$; H8: $\beta = 0.112$, $p = 0.183$; H11: $\beta = 0.081$, $p = 0.363$), whereas perceived usefulness (H1: $\beta = 0.331$, $p < 0.001$) and perceived ease of use (H2: $\beta = 0.231$, $p < 0.01$) were significant in influencing consumers' intention to use blockchain. On the other hand, both compatibility and innovativeness were found to have a positive effect on perceived usefulness (H6: $\beta = 0.409$, $p < 0.001$; H9: $\beta = 0.298$, $p < 0.01$) and perceived ease of use (H7: $\beta = 0.364$, $p < 0.001$; H10: $\beta = 0.265$, $p < 0.01$), respectively, and both social norm and perceived ease of use were not significantly related to perceived usefulness (H3: $\beta = 0.116$, $p = 0.248$; H4: $\beta = -0.026$, $p = 0.777$). To summarize, H1, H2, H6, H7, H9, and H10 were supported, while H3, H4, H5, H8, and H11 were not. Finally, as shown in Table 5, the results revealed that both perceived usefulness and perceived ease of use have a significant mediation effect on the paths of compatibility-intention and innovativeness-intention.

Table 4: The results of hypothesis testing

Path Relationship	Original Est.	Mean	SD	T-Statistics	P-value	2.5% CI	97.5% CI	Result
H1: PU \rightarrow ITU	0.331***	0.333	0.093	3.570	0.000	0.161	0.525	supported
H2: PEOU \rightarrow ITU	0.231**	0.225	0.083	2.795	0.005	0.055	0.377	supported
H3: PEOU \rightarrow PU	0.116 ns	0.119	0.100	1.159	0.248	-0.077	0.314	unsupported
H4: SN \rightarrow PU	-0.026 ns	-0.020	0.091	-0.283	0.777	-0.195	0.156	unsupported
H5: SN \rightarrow ITU	0.072 ns	0.077	0.078	0.919	0.358	-0.080	0.234	unsupported
H6: COM \rightarrow PU	0.409 ***	0.408	0.088	4.626	0.000	0.226	0.573	supported
H7: COM \rightarrow PEOU	0.364 ***	0.362	0.090	4.061	0.000	0.180	0.535	supported
H8: COM \rightarrow ITU	0.112 ns	0.107	0.084	1.331	0.183	-0.061	0.269	unsupported
H9: INNO \rightarrow PU	0.298 **	0.295	0.091	3.273	0.001	0.116	0.475	supported
H10: INNO \rightarrow PEOU	0.265 **	0.275	0.089	2.979	0.002	0.100	0.445	supported
H11: INNO \rightarrow ITU	0.081 ns	0.089	0.089	0.911	0.363	-0.089	0.263	unsupported

SD: Standard Deviation; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; ns: not significant.

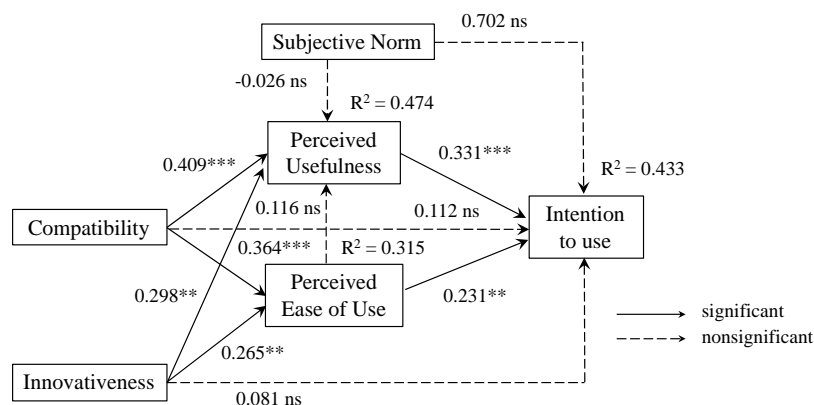


Figure 3: The results of the structural paths

Table 5: The results of mediation effects

Mediation Path	Original Est.	Mean	SD	T-Statistics	P-value	2.5% CI	97.5% CI	Mediation
COM \rightarrow PU \rightarrow ITU	0.135*	0.138	0.053	2.582	0.011	0.050	0.250	significant
COM \rightarrow PEOU \rightarrow ITU	0.084*	0.082	0.038	2.245	0.026	0.017	0.163	significant
INNO \rightarrow PU \rightarrow ITU	0.099**	0.096	0.035	2.803	0.006	0.036	0.171	significant
INNO \rightarrow PEOU \rightarrow ITU	0.061*	0.060	0.028	2.183	0.030	0.013	0.121	significant

SD: Standard Deviation; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

DISCUSSION

The present study offered an empirical analysis focusing on common factors influencing intention to use blockchain and investigated how consumer-related factors (i.e., compatibility, innovativeness, and subjective norm) influence blockchain acceptance in the context of voluntary use. Specifically, this study theorizes the effects of three predictor constructs based on TAM. The model testing analysis confirmed several of the hypotheses and disconfirmed others. Subjective norms showed a nonsignificant effect on perceived usefulness and intention to use blockchain in this study, which is in line with findings from previous studies (e.g., Venkatesh et al., 2003; Davis et al., 1989; Abbasi et al., 2021). This suggests that subjective norms may be more considered in the context of mandatory use, and early adopters, such as educated young people, are generally less affected by the opinions of others. Additionally, perceived ease of use was also found to have a nonsignificant effect on perceived usefulness in this study. This finding may be related to the fact that educated young consumers are accustomed to technology-based goods and services and are likely to be easily aware of technical characteristics (Chau & Hu, 2001; Ioannia et al., 2019).

Moreover, this study indicated that the impacts of compatibility and innovativeness on usage intention were fully mediated by the TAM variables. That is, it appears that consumer characteristics affect intention through the motivational variables and have no additional direct effect on use. This suggests that perceived usefulness and ease of use will increase with users' level of experience in using blockchain and related technologies, as well as the knowledge and related demands they have. In other words, presenting more effective use cases in marketing campaigns, for instance, by showcasing commonly used software or apps that incorporate blockchain technology, will be a more effective way to spark interest and increase public awareness of blockchain technology. Also, this study shows that the higher the users' tendency to try new technology, the easier it is to perceive its usefulness and ease of use, which in turn increases behavioral intention. Therefore, it is suggested that companies that develop or adopt blockchain technology should focus on application innovation and interface design at the early development stage, utilize all available channels to engage users in conversation, and actively adopt suggestions and feedback from consumers.

Meanwhile, this study presents some limitations. Firstly, the sample size was small, and the model did not account for the respondents' familiarity with blockchain technology. This may decrease the accurateness of the findings. As such, future studies should use a larger sample and classify the respondents according to their level of knowledge. This will increase the explanatory power of the research model. The method's quantitative nature presents another drawback. Therefore, a hybrid approach should be taken into consideration for future research, as it will enrich the comprehension of the findings, particularly through the use of interviews with select respondents to gather more in-depth information. Finally, the sample was collected only from China. Thus, future studies should use samples from other countries and cultures in order to increase the generalizability of the results.

REFERENCES

- Abbasi, G. A., Tiew, L. Y., Tang, J., Goh, Y. N., & Thurasamy, R. (2021). The adoption of cryptocurrency as a disruptive force: Deep learning-based dual stage structural equation modelling and artificial neural network analysis. *Plos one*, 16(3), e0247582. <https://doi.org/10.1371/journal.pone.0247582>
- Adams, D. A., Nelson, R. R., & Todd, P. A. (1992). Perceived usefulness, ease of use, and usage of information technology: A replication. *MIS quarterly*, 227-247. <https://doi.org/10.2307/249577>
- Agarwal, R., & Prasad, J. (1999). Are individual differences germane to the acceptance of new information technologies?. *Decision sciences*, 30(2), 361-391. <https://doi.org/10.1111/j.1540-5915.1999.tb01614.x>
- Altamimi, A., Al-Bashayreh, M., AL-Oudat, M., & Almajali, D. (2022). Blockchain technology adoption for sustainable learning. *International Journal of Data and Network Science*, 6(3), 983-994. [10.5267/j.ijdns.2022.1.013](https://doi.org/10.5267/j.ijdns.2022.1.013)
- Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. *Action control: From cognition to behavior/Springer*. https://doi.org/10.1007/978-3-642-69746-3_2.
- Ammar, A. A., Thangarasu, G., Dominic, P. D. D., & Al-Mekhlafi, A. B. A. (2023). A readiness model and factors influencing blockchain adoption in Malaysia's software sector: A Survey Study. *Sustainability*, 15(16), 1-28. <https://doi.org/10.3390/su151612139>.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*. <https://doi.org/10.1037/0033-295X.84.2.191>
- Kumar Bhardwaj, A., Garg, A., & Gajpal, Y. (2021). Determinants of blockchain technology adoption in supply chains by small and medium enterprises (SMEs) in India. *Mathematical Problems in Engineering*, 2021(1), 5537395. <https://doi.org/10.1155/2021/5537395>
- Chau, P. Y., & Hu, P. J. H. (2001). Information technology acceptance by individual professionals: A model comparison approach. *Decision sciences*, 32(4), 699-719. <https://doi.org/10.1111/j.1540-5915.2001.tb00978.x>
- Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management science*, 35(8), 982-1003. <https://doi.org/10.1287/mnsc.35.8.982>
- Marikeyan, D., Papagiannidis, S., Rana, O. F., & Ranjan, R. (2022). Blockchain adoption: A study of cognitive factors underpinning decision making. *Computers in Human Behavior*, 131, 107207. <https://doi.org/10.1016/j.chb.2022.107207>
- Mnif, E., Mouakhar, K., & Jarbou, A. (2021). Blockchain technology awareness on social media: Insights from twitter analytics. *The Journal of High Technology Management Research*, 32(2), 100416. <https://doi.org/10.1016/j.hitech.2021.100416>
- Felin, T., & Lakhani, K. (2018). *What problems will you solve with blockchain?*. Cambridge, MA, USA: MIT Sloan Management Review.
- Fishbein M. & Ajzen, I. (1975). *Beliefs, Attitude, Intention and Behaviour: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.

- Folkinshteyn, D., & Lennon, M. (2016). Braving Bitcoin: A technology acceptance model (TAM) analysis. *Journal of Information Technology Case and Application Research*, 18(4), 220-249. <https://doi.org/10.1080/15228053.2016.1275242>
- Jain, G., Singh, H., Chaturvedi, K. R., & Rakesh, S. (2020). Blockchain in logistics industry: In fizz customer trust or not. *Journal of Enterprise Information Management*, 33(3), 541-558. <https://doi.org/10.1108/JEIM-06-2018-0142>
- Grover Purva, Kar Arpan Kumar, Janssen Marijn, Ilavarasan P. Vigneswara (2019). Perceived usefulness, ease of use and user acceptance of blockchain technology for digital transactions – Insights from user-generated content on Twitter. *Enterprise Information Systems*, 13(6), 771-800. <https://doi.org/10.1080/17517575.2019.1599446>
- Hair, J. F., Matthews, L. M., Matthews, R. L., & Sarstedt, M. (2017). PLS-SEM or CB-SEM: Updated guidelines on which method to use. *International Journal of Multivariate Data Analysis*, 1, 107-123. <https://doi.org/10.1504/IJMDA.2017.087624>
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European business review*, 31(1), 2-24. <https://doi.org/10.1108/EBR-11-2018-0203>
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43, 115-135. <https://doi.org/10.1007/s11747-014-0403-8>
- Ioanna Roussou, Emmanouil Stiakakis, Angelo Sifaleras (2019). An empirical study on the commercial adoption of digital currencies. *Information Systems and e-Business Management*, 17, 223-259. <https://doi.org/10.1007/s10257-019-00426-7>
- Joe Abou Jaoude & Raafat George Saade (2019). Blockchain applications-usage in different domains. *IEEE Access*, 7, 45360-45381. <https://doi.org/10.1109/ACCESS.2019.2902501>
- Kamble, Sachin; Gunasekaran, Angappa; Arha, Himanshu (2019). Understanding the blockchain technology adoption in supply chains-Indian context, *International Journal of Production Research*, 57(7), 2009-2033. <https://doi.org/10.1080/00207543.2018.1518610>
- Kshetri, N. (2018) Blockchain's roles in meeting key supply chain management objectives. *International Journal of Information Management*, 39, 80-89. <https://doi.org/10.1016/j.ijinfomgt.2017.12.005>
- Lacity, M. C. (2018). Addressing key challenges to making enterprise blockchain applications a reality. *MIS Quarterly Executive*, 17(3), 201-222. Retrieved from <https://aisel.aisnet.org/misqe/vol17/iss3/3/>
- Lian, Jiunn-Woei; Chih-Teng, Chen; Li-Fang, Shen; Hung-Ming, Chen (2020). Understanding user acceptance of blockchain-based smart locker, *The Electronic Library*, 38(2), 353-366. <https://doi.org/10.1108/EL-06-2019-0150>
- Liu, N., & Ye, Z. (2021). Empirical research on the blockchain adoption-based on TAM. *Applied Economics*, 53(37), 4263-4275. <https://doi.org/10.1080/00036846.2021.1898535>
- Marengo, A., & Pagano, A. (2023). Investigating the factors influencing the adoption of blockchain technology across different countries and industries: A systematic literature review. *Electronics*, 12(14), 3006. <https://doi.org/10.3390/electronics12143006>
- Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information systems research*, 2(3), 192-222. <https://doi.org/10.1287/isre.2.3.192>
- Nakamoto, S. (2008). *Bitcoin: A peer-to-peer electronic cash system*. Satoshi Nakamoto. Retrieved from <https://bitcoin.org/bitcoin.pdf>
- Levina, N. (2021). All information systems theory is grounded theory. *Mis Quarterly*, 45(1). <https://doi.org/10.25300/MISQ/2021/15434.1.7>
- Ullah, N. (2020, September). Integrating TAM/TRI/TPB frameworks and expanding their characteristic constructs for DLT adoption by service and manufacturing industries-Pakistan context. In *2020 International Conference on Technology and Entrepreneurship (ICTE)* (pp. 1-5). IEEE. <https://doi.org/10.1109/ictte47868.2020.9215537>
- Ullah, N., Mugahed Al-Rahmi, W., Alzahrani, A. I., Alfarraj, O., & Alblehai, F. M. (2021). Blockchain technology adoption in smart learning environments. *Sustainability*, 13(4), 1801. <https://doi.org/10.3390/su13041801>
- 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*, 13(18), 4783. <https://doi.org/10.3390/en13184783>
- Kumar, N., Upreti, K., & Mohan, D. (2022). Blockchain adoption for provenance and traceability in the retail food supply chain: A consumer perspective. *International Journal of E-Business Research (IJEBR)*, 18(2), 1-17. <https://doi.org/10.4018/IJEBR.294110>
- Nuryyev, G., Wang, Y. P., Achyldurdyeva, J., Jaw, B. S., Yeh, Y. S., Lin, H. T., & Wu, L. F. (2020). Blockchain technology adoption behavior and sustainability of the business in tourism and hospitality SMEs: An empirical study. *Sustainability*, 12(3), 1256. <https://doi.org/10.3390/su12031256>
- Parasuraman, A. (2000). Technology readiness index (TRI) a multiple-item scale to measure readiness to embrace new technologies. *Journal of service research*, 2(4), 307-320. <https://doi.org/10.1177/109467050024001>
- Plouffe, C. R., Hulland, J. S., & Vandenbosch, M. (2001). Richness versus parsimony in modeling technology adoption decisions—Understanding merchant adoption of a smart card-based payment system. *Information systems research*, 12(2), 208-222. <https://doi.org/10.1287/isre.12.2.208.9697>
- Queiroz, M. M., & Wamba, S. F. (2019). Blockchain adoption challenges in supply chain: An empirical investigation of the main drivers in India and the USA. *International Journal of Information Management*, 46, 70-82. <https://doi.org/10.1016/j.ijinfomgt.2018.11.021>
- Rogers, E. M. (1962). *Diffusion of innovations* (1st ed.). New York: Free Press.

- Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). New York: Free Press.(p.15, 229).
- Shrestha, A. K., & Vassileva, J. (2019, December). User acceptance of usable blockchain-based research data sharing system: an extended TAM-based study. In *2019 First IEEE International Conference on Trust, Privacy and Security in Intelligent Systems and Applications (TPS-ISA)* (pp. 203-208). IEEE. 10.1109/TPS-ISA48467.2019.00033
- Tandon, A., Kaur, P., Mäntymäki, M., & Dhir, A. (2021). Blockchain applications in management: A bibliometric analysis and literature review. *Technological Forecasting and Social Change*, 166, 120649. <https://doi.org/10.1016/j.techfore.2021.120649>
- Tedjo, A. T., Tee, P. K., & Ahmad, R. (2022). A study on the factors boosting customer experience in the adoption of smart locker in Klang valley. *International Journal of Academic Research in Business and Social Sciences*, 12(5), 430-443. <http://dx.doi.org/10.6007/IJARBS/v12-i5/13113>
- Tornatzky, L. G., & Klein, K. J. (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on Engineering Management*, (1), 28-45. <http://dx.doi.org/10.1109/TEM.1982.6447463>
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478. <https://doi.org/10.2307/30036540>
- Venkatesh, V., & Davis, F. D. (1996). A model of the antecedents of perceived ease of use: Development and test. *Decision sciences*, 27(3), 451-481. <https://doi.org/10.1111/j.1540-5915.1996.tb00860.x>
- Morkunas, V. J., Paschen, J., & Boon, E. (2019). How blockchain technologies impact your business model. *Business Horizons*, 62(3), 295-306. <https://doi.org/10.1016/j.bushor.2019.01.009>
- Zhou, Y., Wang, W., Wang, K., & Song, J. (2022). Application of LightGBM algorithm in the initial design of a library in the cold area of China based on comprehensive performance. *Buildings*, 12(9), 1309. <https://doi.org/10.3390/buildings12091309>
- Wood, S. L., & Swait, J. (2002). Psychological indicators of innovation adoption: Cross-classification based on need for cognition and need for change. *Journal of Consumer Psychology*, 12(1), 1-13. https://doi.org/10.1207/S15327663JCP1201_01
- Chang, Y., Iakovou, E., & Shi, W. (2020). Blockchain in global supply chains and cross border trade: A critical synthesis of the state-of-the-art, challenges and opportunities. *International Journal of Production Research*, 58(7), 2082-2099. <https://doi.org/10.1080/00207543.2019.1651946>
- Chengyue, Y., Prabhu, M., Goli, M., & Sahu, A. K. (2021). Factors affecting the adoption of blockchain technology in the complex industrial systems: data modeling. *Complexity*, 2021(1), 8329487. <https://doi.org/10.1155/2021/8329487>
- Kawasmi, Z., Gyasi, E. A., & Dadd, D. (2020). Blockchain adoption model for the global banking industry. *Journal of International Technology and Information Management*, 28(4), 112-154. <https://doi.org/10.58729/1941-6679.1436>