

FACTORS AFFECTING BLOCKCHAIN ADOPTION IN INDONESIA

Gaguk Dwi Prasetyo Atmoko, Dewi Tamara, David Yuwono, Sarah Fauziah

Binus Business School, Binus University Jakarta, Indonesia

Email: gaguk.atmoko@binus.ac.id, dtamara@binus.edu, david.yuwono@binus.ac.id,
sara.fauziah001@binus.ac.id

Abstract

Two cognitive beliefs in the Technology Acceptance Model (TAM), namely perceived usefulness and perceived ease of use, have been considered central in determining acceptance of information technology in recent decades. These two cognitive beliefs are not necessarily able to fully explain user behavior towards new information technologies such as blockchain technology, so this study will explore the factors that influence the acceptance of blockchain technology in Indonesia by integrating the TAM model with aspects of perceived security, perceived risk, trust, perceived strategic value, and cost-saving to develop a comprehensive TAM. Based on a survey conducted on 250 people who work in the banking, telecommunications, and government sectors as well as the research design using quantitative, the model was tested using a structural equation modeling which resulted in empirical findings stating that there was a significant effect given by perceived security, perceived risk, trust, perceived strategic value, and cost-saving, to the acceptance of blockchain technology.

Keywords: blockchain; technology acceptance model; perceived security; perceived risk; trust; perceived strategic value; cost saving

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Introduction

Many studies in the last decade have examined perceived usefulness and perceived ease of use as determining factors in the acceptance of information technology (Yudaruddin, 2010) According to (Davis, 1986), this construction is the main belief that underlies the Technology Acceptance Model (TAM). TAM is the most widely used model to explain the factors that influence users in accepting information technology. Many studies have shown that TAM is proven to have a high level of validity in various information technologies (Davis, 1986). However, the factors that contribute to the acceptance of new information technologies tend to vary between technologies, users, and contexts (Yudaruddin, 2010). Blockchain is very different from today's information technology, with a distributed consensus-based and immutable ledger transaction record (Yudaruddin, 2010), (Yudaruddin, 2010). Blockchain presents a new paradigm for the business world so that Blockchain can serve as a pragmatic solution to business problems as a connecting platform that can enable multiple business

processes. Blockchain is one of the crucial technologies in supporting efficiency and transparency so that it can be used in anticipating the rapid development of business competition.

The consensus-based or agreement-based transaction process of the parties involved in the transaction can eliminate the need for a third party or central authority (Yudaruddin, 2010) so can eliminate the costs for third-party services. Cost savings from the use of information technology are important factors that can influence the users to adopt information technology (Meuter et al., 2000). Cost savings in a business are part of the perceived strategic value in adopting information technology according to research conducted by (Yudaruddin, 2010) which states that by adopting information technology, business processes become more accessible and faster, can affect productivity, profitability, and increase the number of consumers. Apart from technological developments that provide convenience in terms of digital payments (Yudaruddin, 2010), which are carried out using modern communication networks facilitated by the internet (Yudaruddin, 2010), there are some concerns about information technology users regarding security about personal information from various aspects that can be seen, stored and manipulated by other parties who are not involved in the transaction so it can consistently affect user trust (Yudaruddin, 2010). In addition, the use of new technology can also produce uncertain consequences that can lead to risks that refer to losses derived from uncertainty (Murray & Schlacter, 1990) so that there is a need for trust between the parties in order to anticipate by taking appropriate action (Murray & Schlacter, 1990).

Because information technology users pay attention to perceived security and perceived risk, this condition greatly affects the Blockchain, which distributed ledger transaction records then all user's information can be opened by anyone who connects to the blockchain network. Therefore, unlike in previous information technology research, perceived ease of use and perceived usefulness may not necessarily describe the user's full acceptance of new information technologies such as Blockchain.

The limitations of this research on the topic of blockchain acceptance leave much to be discovered (Murray & Schlacter, 1990). There is a scarcity of supporting content that enables proper analysis and research of Blockchain. This is due to two main reasons: the relative novelty of blockchain technology, especially in an independent framework, many have been done to study Blockchain-related with sustainability and scalability in general, but it is only a few that Blockchain has started to be considered as an independent technology, therefore requires further study of user perceptions of Blockchain. The second cause is the lack of exploratory research related to blockchain acceptance. This leads to a lack of identifiable constructs and reliable measures that can be used to investigate the relationship between Blockchain and overall user acceptance.

In this study, TAM is used as the basic model, which is integrated with several other factors that reflect the characteristics of the Blockchain so as to produce a comprehensive research model. This study proposes Perceived Security, Perceived Risk, Trust, Perceived Strategic Value, and Cost Saving to increase understanding of user

acceptance of Blockchain. In testing the research model, this study uses a Structural Equation Modeling (SEM) approach with the hope of producing reliable constructs and measurements that can be used to investigate the relationship between Blockchain and overall user acceptance so that it can help researchers, developers, and managers to understand the determinants of user acceptance of Blockchain.

Research Methods

Research on the factors that influence blockchain adoption in Indonesia uses quantitative research methods with an explanatory approach. Quantitative methods in this research are used to develop mathematical models and theories, and hypotheses related to research. Meanwhile, the explanatory approach is used to obtain more information based on a literature review and/or quantitative approach in data collection to test a hypothesis in order to strengthen or possibly reject the hypothesis of the research results. The research strategy that we used is a survey strategy because it can reach a population of various industries that can use Blockchain to support their business. In conducting the survey, it was carried out to parties who were not related to the researcher by distributing questionnaires to respondents representing several industrial sectors, especially the banking, telecommunications, and government industries who understood blockchain technology with questions that could indicate the correlation between one variable and another. So that the solution can be found without manipulating the survey results that describe normal conditions. The data collection process is carried out by collecting data for 1 month with an individual analysis unit representing the industry in Jakarta.

The research design is structured in such a way with the aim of exploring the factors that can influence blockchain adoption in Indonesia as well as testing how these factors can influence other factors. This is necessary considering that the development of blockchain adoption in Indonesia has not been too significant so that there is no available information regarding similar problems or research issues that have been solved in the past related to blockchain adoption, while overseas research related to Blockchain has grown rapidly and has shown a positive impact on development businesses from various sectors.

The population used in the study of the factors that influence blockchain adoption in Indonesia are all employees from the banking, telecommunications, and government industries. In comparison, the unit of analysis is all employees of the institution who understand and have the capacity to analyze the feasibility of blockchain adoption. The parameters that will be examined include Respondents perceived security, Respondents perceived risk, Respondents' trust in blockchain technology, Respondents perceived cost savings, Respondents perceived benefits, Respondents perceived convenience, Strategic value to blockchain adoption perceived by respondents, Respondent's attitude towards blockchain adoption and intention to adopt Blockchain. In sampling using the non-probability cluster random sampling method, this study takes the same sample for each company included in the industry category above, and because there are many and it is

impossible to take from all companies, we made clusters including banking industry clusters, telecommunications industry clusters, and government clusters. With the arrangement of clusters that can represent all industrial sectors selected because of their involvement in blockchain adoption, the sample size is in accordance with the reference given by (Murray & Schlacter, 1990), which states that in multivariate research, it is better to use a sample of 10 times larger than the number of variables used. This study uses 9 variables so that the sample size used is at least 90, but to better describe normal conditions, this study uses a minimum of 200 samples for all units of analysis from the 3 clusters.

Results and Discussions

A. Discussion

To explain the causal relationship between constructions in the research model, two stages of testing were carried out, namely testing the validity and reliability of the data and testing the structural equation model.

1. Measurement Model

In measuring a research model using a construction validity test by measuring instrument, in this case, the questionnaire used can measure the meaning of the model being measured. In conducting the validity test, there are two types of validity, namely content validity and criteria validity that must be tested, where content validity is used to test the extent to which the questionnaire can measure the content of a variable to be measured because the variables used are adopted from international journals that have been recognized so that they are quite valid to use. In contrast, the validity of the criteria is used to test the correlation between one variable and another. The method used in this study is a convergent validity test which refers to the suggestion of (Hult et al., 2018) which states that the loading factor value of each question indicator must be greater than 0.50. With these conditions, the perception of all variables as outlined through the questions in the questionnaire can be observed properly and can measure the latent variables correctly. Based on the results of the study, the value of the loading factor / Outer Loading for all variables showed a value of > 0.50 as presented in Table 1 with the measurement model shown in Figure 2. Thus all variables used in this study were valid.

Table 1
Outer Loading

	ATT	BI	CS	PEOU	PR	PS	PU	PSV	TR
AT1	0,914								
AT2	0,903								
BI1		0,849							
BI2		0,848							
BI3		0,846							
BI4		0,750							
CS1			0,885						

	ATT	BI	CS	PEOU	PR	PS	PU	PSV	TR
CS2			0,868						
CS3			0,897						
CS4			0,680						
PE1				0,826					
PE2				0,689					
PE3				0,837					
PE4				0,780					
PE5				0,849					
PR1					0,893				
PR2					0,881				
PR3					0,931				
PR4					0,906				
PS1						0,840			
PS2						0,890			
PS3						0,875			
PU1							0,846		
PU2							0,865		
PU3							0,836		
PU4							0,838		
PU5							0,837		
PV1								0,871	
PV2								0,842	
PV3								0,506	
PV4								0,770	
TR1									0,878
TR2									0,841
TR3									0,711
TR4									0,774
TR5									0,803

ATUB: Attitude to Use Blockchain; BITUB Behavioral Intention to Use Blockchain;
 CS: Cost Saving; PEOU: Perceived Ease of Use; PR: Perceived Risk; PS: Perceived
 Security; PU: Perceived Usefulness; PSV: Perceived Strategic Value; TR: Trust

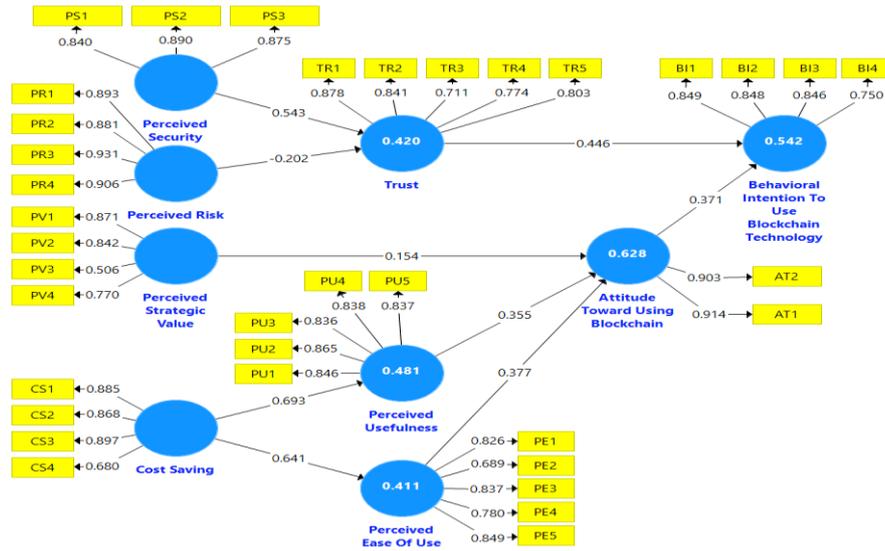


Figure 2
Measurement Model

1) Construct Reliability

After testing the validity by checking Factor Loading/Outer Loading, it is necessary to test the composite reliability as suggested by (Shiau et al., 2019) and the extracted mean variance proposed by (Hult et al., 2018), which states that all construction values used in the research model must have a CR value of more than 0.7 and an AVE value of more than 0.5 as presented in Table 2. Thus all variables used in this study are reliable.

Table 2
Construct Reliability

	CA	RA	CR	AVE
Attitude Towards Using Blockchain	0,790	0,791	0,905	0,826
Behavioral Intention to Use Blockchain	0,842	0,844	0,894	0,680
Cost Saving	0,853	0,867	0,903	0,701
Perceived Ease of Use	0,856	0,864	0,897	0,637
Perceived Risk	0,924	0,931	0,946	0,815
Perceived Security	0,837	0,838	0,902	0,755
Perceived Strategic Value	0,752	0,808	0,842	0,579
Perceived Usefulness	0,899	0,900	0,926	0,713
Trust	0,862	0,876	0,901	0,645

CA: Cronbach's Alpha; RA: rho_A; CR: Composite Reliability; AVE: Average Variance Extracted

2) Discriminant Validity

After conducting a reliability test by examining CR and AVE, Fornell (1981) suggested the need to test Discriminant Validity (DV) based on cross-loading with latent variables, namely comparing the value of the square root of AVE for each variable with the correlation between the variable and other variables in the model (Fornell Larcker Criterion). If the measurement value of the square root of AVE is greater than the correlation value between variables and other variables in the model, it can be concluded that the variable has a good DV value and vice versa. The results of the study, as shown in Table 3, show that all the variables used in this study have good discriminant validity values.

Table 3
Discriminant Validity

	ATUB	BITU B	CS	PEO U	PR	PS	PSV	PU	TR
Attitude Towards Using Blockchain	0,909								
Behavioral Intention To Use Blockchain Technology	0,647	0,824							
Cost Saving	0,629	0,641	0,837						
Perceived Ease Of Use	0,727	0,729	0,641	0,798					
Perceived Risk	-0,375	-0,371	-0,316	-0,393	0,903				
Perceived Security	0,570	0,560	0,560	0,599	0,388	0,869			
Perceived Strategic Value	0,624	0,678	0,602	0,624	0,323	0,500	0,761		
Perceived Usefulness	0,726	0,742	0,693	0,716	0,413	0,626	0,660	0,844	
Trust	0,619	0,676	0,677	0,768	0,412	0,621	0,631	0,705	0,803

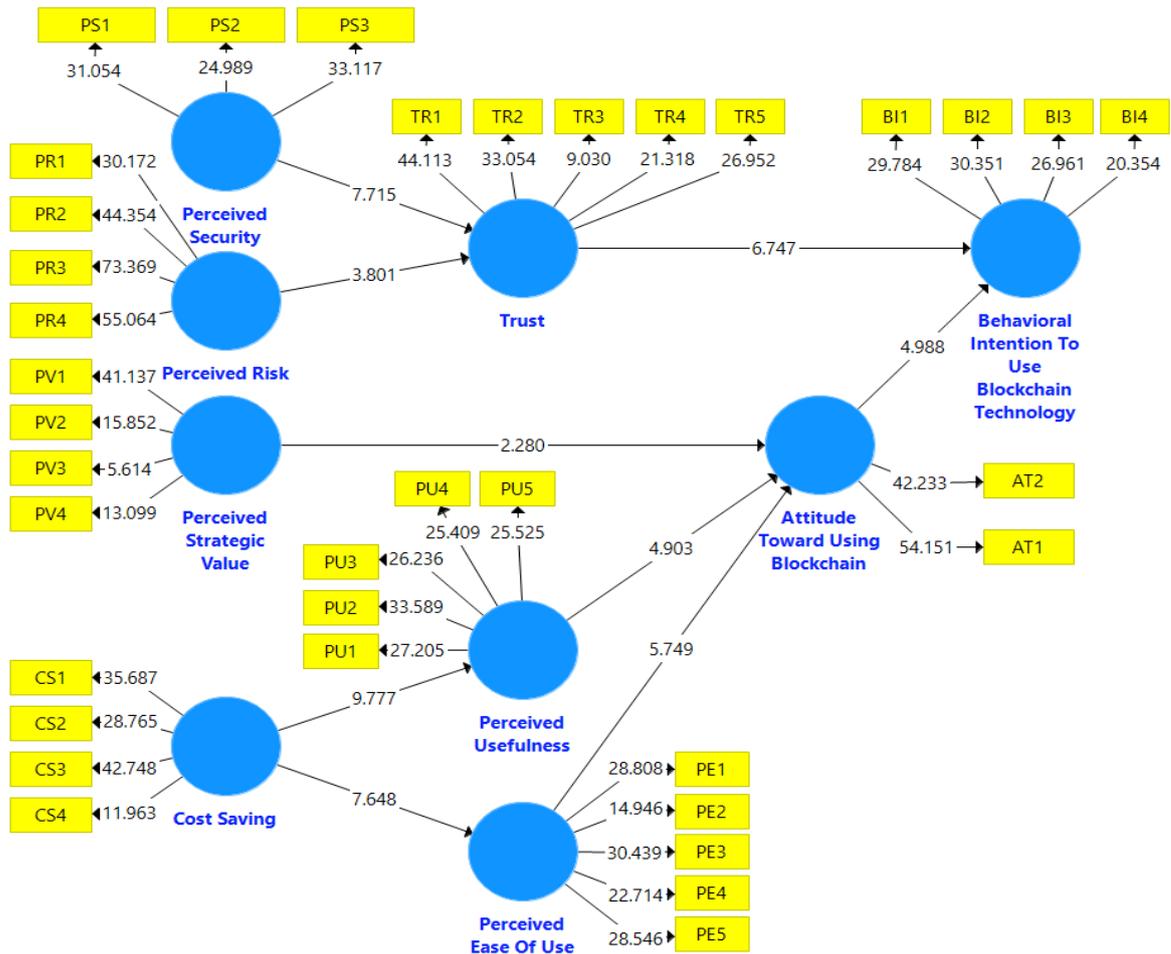
ATT: Attitude to Use Blockchain; BI: Behavioral Intention to Use Blockchain; CS: Cost Saving;

PEOU: Perceived Ease of Use; PR: Perceived Risk; PS: Perceived Security; PU: Perceived Usefulness;

PSV: Perceived Strategic Value; TR: Trust

2. Structural model

In the second stage, the data normality test was carried out by applying a bootstrapping process using a large sample of 5000 samples from 250 original samples for error checking, which resulted in a T-value to prove the significance of the measurement model. The process of bootstrapping the structural model is shown in Figure 3.



2) Goodness of Fit Model

Five measures applied in this study, namely SRMR, d ULS, d G, Chi-square, and NFI, were used to determine the goodness of model fit obtained by including the exclusion process. According to (Go et al., 2013), the standard SRMR value is less than 0.08, while the research results shown in Table 5 get a value of 0.071, so that the model is considered suitable. As for the NFI, the value for this statistical range is between 0 – 1 with a value closer to 1 the better, and the results of the study show a value of 0.730 so that the model has a fairly good level of conformity although (Brett et al., 1990) recommend a value greater than 0.90 which showed good fit and a more recent suggestion suggested that the cutoff criterion should be NFI 0.95 (Hu & Bentler, 1999).

Table 5
Fit Model

	R²	R²		SM	EM
		Adjuste			
		d			
Attitude Towards Using Blockchain	0,628	0,623	SRMR	0,071	0,172
Behavioral Intention to Use Blockchain	0,542	0,538	d_ULS	3,329	19,686

	R ²	R ² Adjusted		SM	EM
Perceived Ease of Use	0,411	0,408	d_G	1,295	1,731
Perceived Usefulness	0,481	0,479	Chi-Square	1967,903	2233,328
Trust	0,420	0,415	NFI	0,730	0,694

SM = Saturated Model, EM = Estimated Model

Table 6. Hypothesis Test Results.

	OS	SM	SD	T Values	P Values	Decision
H1 PS → TR	0,543	0,544	0,070	7,715	0,000	Accepted
H2 PR → TR	-0,202	-0,202	0,053	3,801	0,000	Accepted
H3 TR → BI	0,446	0,449	0,066	6,747	0,000	Accepted
H4 PSV → ATT	0,154	0,164	0,068	2,280	0,023	Accepted
H5 CS → PU	0,693	0,690	0,071	9,777	0,000	Accepted
H6 CS → PEOU	0,641	0,638	0,084	7,648	0,000	Accepted
H7 PU → ATT	0,355	0,348	0,072	4,903	0,000	Accepted
H8 PEOU → ATT	0,377	0,371	0,066	5,749	0,000	Accepted
H9 ATT → BI	0,371	0,363	0,074	4,988	0,000	Accepted

OS: Original Sample Beta; SM: Sample Mean; SD: Standard Deviation

ATT: Attitude to Use Blockchain; BI: Behavioral Intention to Use Blockchain; CS: Cost Saving;

PEOU: Perceived Ease Of Use; PR: Perceived Risk; PS: Perceived Security; PU Perceived Usefulness;

PSV: Perceived Strategic Value; TR: Trust

3) Structural Model Assessment

According to the guidelines, the P-Values and T-Values that showed a significant effect were $P < 0.05$ and $T > 1.96$. Based on the results of hypothesis testing, it shows a significant effect of PS on TR with a value of $T = 7.715$ and $P = 0.000$, both of which meet the guidelines so that hypothesis 1 is accepted. The study also showed that PR had a significant effect on TR with a value of $T = 3.801$ and $P = 0.000$, both of which met the guidelines so that hypothesis 2 was accepted. In addition, the results of hypothesis testing also show that TR has a significant effect on BI with a value of $T = 6.747$ and $P = 0.000$, both of which meet the guidelines so that hypothesis 3 is accepted. PSV also showed a significant effect on ATT with a value of $T = 2.280$ and $P = 0.023$, both of which met the guidelines so that hypothesis 4 was accepted. A significant effect was also shown by CS on PU with a value of $T = 9.777$ and $P = 0.000$, both of which met the guidelines so that hypothesis 5 was accepted. In addition to PU, CS also showed a significant effect on PEOU with a value of $T = 7.648$ and $P = 0.000$ so that both of them met the guidelines so that hypothesis 6 was accepted. PU as the main construct in TAM also shows a significant effect on ATT with values of $T = 4.903$ and $P = 0.000$, both of

which meet the guidelines so that hypothesis 7 is accepted. Likewise, PEOU has a significant effect on ATT with a value of $T = 5.749$ and $P = 0.000$, both of which meet the guidelines so that hypothesis 8 is accepted. And lastly, ATT has a significant effect on BI with a value of $T = 4.988$ and $P = 0.000$, both of which meet the guidelines so that hypothesis 9 is accepted. This is in accordance with what is shown in Table 6 that all hypotheses have a significant relationship.

The results showed that Perceived Security had a significant positive effect on Trust Perception, which was supported by (Maqableh et al., 2015). However, Perceived Risk Perception shows a significant negative effect on Perceived Trust, which is supported by Gil-Cordero's research (2020). Meanwhile, Trust Perception has a significant positive effect on Behavioral Intention To Use Blockchain, which is supported by Gil-Cordero's research (2020). Perceived Strategic Value also shows a significant positive influence on Attitude Towards Using Blockchain, which is supported by (Tonkin, 2013). Perceived Cost Saving has a significant positive effect on Perceived Usefulness, which is supported by (Winkler et al., 2020). Perception of Cost Saving has a significant positive effect on the perception of Perceived Ease of Use, which is supported by (Winkler et al., 2020). Perceived usefulness shows a significant positive effect on Perception of Attitude Towards Using Blockchain, which is supported by (Khan et al., 2021). Meanwhile, Perceived Ease of Use has a significant positive effect on Perceptions of Attitude Towards Using Blockchain, which is supported by (Khan et al., 2021). And Perception of Attitude Towards Using Blockchain shows a significant positive influence on Perception of Behavioral Intention to Use Blockchain, which is supported by (Khan et al., 2021).

So, the results of this study show us that all hypotheses are accepted. This may be because the survey was conducted on organizations that really need Blockchain to support their operational activities. This might have different results if the survey was conducted on other organizations that still consider the technology of supporting business, not as a main core of the business.

Conclusion

From the research that has been done, it can be concluded: (1.) Limitations and Conclusions. In this study, there are limitations as in previous studies. The first limitation is that the research is only conducted in the banking sector with respondents selected from banks that are in the big 5 categories, while the telecommunications industry sector is selected as the largest, and for the government, only regulators are selected in the financial services industry. In the future, it is necessary to conduct research involving the majority of categories equally for the banking, telecommunications, and government sectors. Besides that, it is necessary to involve other sectors so that it better illustrates the acceptance of Blockchain in the majority of sectors with more attractive results. The second limitation is that this study integrates the main constructs of TAM (perceived ease of use, perceived usefulness, attitudes, and behavioral intentions) with cost savings, perceived strategic value, perceived security,

perceived risk, and trust. In the future, it can be integrated with other adoption theories such as government regulation so as to obtain more interesting research results. The third limitation is that Blockchain is not a stand-alone technology which in this study does not integrate the distribution of ledger technology with other technologies. In the future, it is necessary to integrate with other applications such as ERP and other technologies such as the internet of things with research results expected to be more useful for organizations. The fourth limitation is that few studies have been conducted on the costs associated with the adoption of distributed ledger technology apart from prototype research (Maqableh et al., 2015). In the future, further research on similar technologies is needed as companies planning to integrate distributed ledger technology into their traditional commerce need more attention to their needs. In conclusion, this study expands the construction of a technology acceptance model with security, risk, cost, strategic value, and trust for blockchain acceptance in Indonesia. Based on these results, it was confirmed that perceived security perception, perceived risk perception, trustworthiness perception, cost savings perception, ease of use perception, perceived usefulness perception, perceived strategic value perception, and attitude towards blockchain use showed positive effects on behavior to use Blockchain. The results show that the attitude towards the use of Blockchain has the most influence on behavior to use the Blockchain by 62.8%, followed by the benefits of using it by 48.1%. This research has an important role in showing that most of the technology adoption approaches have been studied by developed countries (Zia-Ul-Haq et al., 2007). Therefore, this research is unique in that it offers a holistic model for new technology adoption by suggesting a valuable vision for improving useful technology solutions. (2.) Theoretical implications This study follows up on research conducted by (Ying et al., 2018), which emphasizes the vital need to increase research related to blockchain topics. Until recently, the literature on distributed ledger technology was usually in the form of reviews such as (Siegel et al., 2019) By using research using the TAM construct as well as empirical evidence from the banking, telecommunications, and government sectors, this study complements the distributed ledger literature of recognition models for new technologies by analyzing empirical models. Also, this research plays a key role in the application of Blockchain for the banking, telecommunications, and government sectors to anticipate the impact of blockchain technology developments. Moreover, this research is a preliminary study using SmartPLS, the findings of which are statistically confirmed models, showing that TAM builds a construct of trust, ease of use, and benefits that can form the basis of blockchain acceptance in banking, telecommunications, and government sectors. (3.) Practical Implications The results show that the research model has a strong influence of 54.2%, which is indicated by the R² value of 0.542 and the adjusted R² of 0.538 originating from the Behavioral Intention variance. Meanwhile, the Perceived Ease of Use has an influence of 41.1%, which is indicated by the R² value of 0.411 and the adjusted R² of 0.408. Perceived usefulness showed an effect of 48.1%, which was indicated by the R² value of 0.481 and the adjusted R² of 0.479. Likewise, trust has an influence of 42% as indicated by

the R2 value of 0.420 and adjusted R2 of 0.415. Therefore, the attitude shows a strong influence of 62.8%, which is indicated by the R2 value of 0.628 and adjusted R2 of 0.623. Distributed ledger technology has begun to be adopted by developing countries (Bregante et al., 2020). While in Indonesia, the understanding of Blockchain is still limited, however, there is a movement towards blockchain adoption from several sectors in Indonesia, and the adoption of distributed ledger technology is reflected by the optimistic opening to become economical around the world (Tapscott, 2016). The application of distributed ledger technology should bring trust, cost reduction, convenience, and benefits to users (Zhu et al., 2020). Based on the benefits, the distribution of ledgers can promote transaction security and data security as well as reduce transaction risks, so in turn, technology can advance business convincingly by encouraging the sustainability of appropriate implementation and targeted technologies.

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