THE POTENTIAL APPLICATION OF BLOCKCHAIN AND CONTROL TOWER IN DOMESTIC FORWARDING BUSINESS IN INDONESIA

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Abstract: On the global rapid movement, forwarding business face challenges both from the financial and operational aspects within all parties. Advanced growth of information technology through blockchain and control tower model can be a solution which tailored by logistics services provider. The purpose of this study is to analyze the relevant variables that are critical to access the potential adoption of blockchain and control tower scheme for forwarding business activities. Technology Acceptance Model with Partial Least Square used to analyze variables that come from supply chain issues, technologies readiness, cost of technologies, the character of stakeholder, the character of user, perceived ease of use, and perceived usefulness which will influence the intention to use of the blockchain and control tower scheme. Population size of this study coming from 93 respondents of logistics professional in Indonesia with convenience sampling method technique. Based on the 8 hypotheses that developed, the result explained that there are 4 acceptances and 4 rejections of hypotheses. The conclusion explains that Supply Chain Issue have positive impact to Perceived Usefulness, Characters of Stakeholders and Characters of User have positive impact to Perceived Ease of Use, and Cost of Technologies have positive impact to Intention to Use of Blockchain and Control Tower.

Keywords: forwarding business, technology acceptance model, blockchain, control tower, partial least square

Abstrak: *Pada pergerakan kondisi global yang cepat, bisnis forwarding menghadapi tantangan dari sisi keuangan maupun operasional atas semua pihak yang terlibat. Pertumbuhan teknologi informasi yang maju melalui skema blockchain dan menara kontrol dapat menjadi solusi yang disediakan oleh penyedia jasa logistik. Tujuan dari penelitian ini adalah untuk menganalisis variabel yang sesuai dan memiliki potensi di dalam penggunaan skema blockchain dengan menara kontrol di dalam bisnis forwarding. Technnology Acceptance Model dengan Partial Least Square digunakan untuk menganalisa variabel yang berasal dari masalah rantai pasok, kesiapan teknologi, biaya teknologi, karakter pemanggu kepentingan, karakter pengguna, persepsi kemudahan, persepsi manfaat yang akan mempengaruhi niat untuk menggunakan skema blockchain dengan skema menara kontrol. Populasi penelitian berasal dari 93 sample respondent yang berasal dari profesional di bidang logistik di Indonesia dengan menggunakan teknik convenience sampling. Berdasarkan 8 hipotesis study, hasil olah data menyatakan bahwa terdapat 4 hipotesis yang diterima dan 4 hipotesis yang ditolak. Hasil penelitian menjelaskan bahwa masalah rantai pasok berpengaruh positif terhadap persepsi manfaat, karakter pemangku kepentingan dan karakter pengguna berpengaruh positif terhadap persepsi kemudahan dan biaya teknologi berpengaruh positif terhadap niat untuk penggunaan Blockchain dengan menara kontrol.*

Kata kunci: *bisnis forwarding, technology acceptance model, blockchain, menara kontrol, partial least square*

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INTRODUCTION

Supply chain management is a process to manage the flow of goods and services that starting from the raw material into finished goods within the organization. Managing supply chain in this rapid growth become the most challenging moment. The freight forwarder has multi-echelon in supply chain area need to improve their ability to ensure all end-to-end process performed well and can satisfy the customer. In this recent day, the development of technology also creating disruptive events in the running of supply chain operations and processes. One of the most recent developments is blockchain technology (Wang et al. 2019). Blockchain is a promising technology that can be considered as a viable solution for protecting data from an alteration in smart city applications. The blockchain technology introduces a distributed ledger that is transparent and decentralized. Blockchain represents a way to record transactions or any digital interactions that are secure, transparent, highly resistant to outages, auditable, and efficient. These features encourage supply chain and operations applications to combine their IoT networks with blockchain technology. A combination of sensor, IoT, and blockchain technologies provides a verifiable, secure, and robust mechanism for storing and managing data generated or processed by connected smart devices (Merkx, 2019). There are previous researches mentioning about the potential application of blockchain in smart city (Moin et al. 2019) and retail management (Merkx, 2019). With the development of current complex information flow processes, forwarder may use blockchain as an option to solve the problems, including the financial reporting. Financial reporting is very important process in the operational process of freight forwarder while most of the reporting system still done manually nowadays, thus, the implementation of blockchain and control tower is one of the solutions.

Previous study analyzes the implementation blockchain integrated with Control Tower that being used in trucking industry under freight broker which taken place in USA and Turkey (Alacam et al. 2021). That research used technology to improve transparency and traceability. Integrated of blockchain as used in smart contract and control tower for end-to-end monitoring provide some benefits to the users in that industry. Furthermore, that research design the operational model based on interviews with subject matter expert and literature review in order to understand the needed of their industry.

Another study proposed blockchain model on the maritime logistics especially to be used in international freight transport (Irannezhad, 2020). This study conducts in Australia and being used literature review to proposed design process of collaboration between all parties on the international forwarding with blockchain model. Learned that some challenges still need to solve in terms of benefit that arise due to the function of integrated system under blockchain.

Blockchain also been used in supply chain area especially in procurement, manufacturing and logistics and distribution area (Kamble et al. 2019). The extended of using in collaboration with Control Tower also managed for monitoring real time end to end trucking with smart contract under blockchain scheme (Alacam et al. 2021). Integrated collaboration with many parties on forwarding business bring an important analysis to conduct benefit for the stakeholders. This condition pushes every aspect to be more agile and being flexible with all changing working environments to build sustainability to passing this situation. The current situation will not last forever, however, it is important to understand the impacts of our business in order to adapt the forwarding business to increase the resilience (Moin et al. 2019).

Based on some previous research, we conduct the analyzing of potential used blockchain and control tower in Indonesia. Researcher would like to defined some variables under Technology Acceptance Model that will be influence to the potential used of this scheme to improve collaboration among the domestic forwarding process. Researcher taken domestic forwarding on the scope of research study to be focus in managing challenges in Indonesia operational, government polies and also human behavior that involved in this process. This study aims to provide some insight to the stakeholders related which factors that could be have high influence of considerations to used blockchain and control tower for managing their operational and financial activities. The goal of this research is to identify the factors which have the highest impact to be successful for the implementation of blockchain with control tower in domestic forwarding business at Indonesia.

This research would like to answer some research questions as follow: a) what are observed variables that construct and build external variables; b) how was the influence of external variables, perceived usefulness,

perceived ease of use regarding the intention to use of blockchain and control tower system.

METHODS

This research used primary data through an online questionnaire to collect response from respondent to be used for analyzing. Researcher spread online questionnaire link into the social media channel or group WhatsApp discussion which comprise of logistics professional in Indonesia. Period of collection data was on September until November 2022.

There are two sections on the questionnaire which started with background information of respondent and then the response of correlation for exogeneous and endogenous variables related the potential application of Blockchain and Control Tower. This study used Likert 5 scales for each question on the sections of correlation variables.

The population of this research is logistics professional in Indonesia which work on supply chain sectors. They are coming from manufacturing, logistics services provider and consultant. This study has 8 latent variables with 30 observed variables, maximum construct with 4 variables with significant level 5% and minimum R2 0.5 then makes it should have at least 42 respondents. The sample size using Smart-PLS software don't need to much sample and normal distribution due to running the model with variance data using bootstrapping technique (Hair et al. 2014).

Based on previous section which indicating required at least 42 samples, this research used convenience sampling technique (Taherdoost, 2016). This method under non probability sampling scheme which conduct from logistics professional industry and to contribute for this research study.

Data analysis based on questionnaire divided into 2 processes which are statistics descriptive and causal analysis. Descriptive analysis used to summarize the data to represent a entire sample in research population. Causal Analysis of this research based on Confirmatory Factor Analysis with Partial Least Square used to prove the theory which explains the correlation of latent and observed variable regarding this research topic (Taherdoost, 2016).

The researcher builds the model based on a previous study (Queiroz et al. 2019; Kamble et al. 2019; Chowdhury et al. 2022; Sciarelli et al. 2022; Saputra et al. 2022) to analyze the potential application of Blockchain and Control Tower in Domestic Forwarding Business at Indonesia. There will be several observed variables and defined the hypothesis to being used in this study.

The researcher defined total of 7 variables latent as exogenous variables equipped into total 27 observed variables and 1 variable latent as an endogenous variable with equipped the 3 observed variables. The exogenous variables explain on the following part. Supply Chain Issue defined as problem that arise on daily business activities which indicated needed solutions from Blockchain and Control Tower. Exogenous variable for Supply Chain Issue have observed variable as follows: lack of visibility which express that information on supply chain across operational and financial still low (Wu et al. 2017; Kamble et al. 2019; Balci et al. 2021), less scalability is talking about system capability to adaptable for information sharing based on volume transaction (Hellani et al. 2020; Kfoury, 2021; Jung, 2022) payment delay explain that problem in cash received from customer (Marbouh et al. 2020; Irannezhad, 2020; Tseng et al. 2021), and ineffective administration defined as too much involvement of document which arise inefficient process during supply chain activities (Feyissa et al. 2019; Patsavellas et al. 2021; Keresztes et al. 2022). Technologies readiness express as a capability of Blockchain and Control Tower system information to support the supply chain activities. Exogenous variable for Technologies Readiness have observed variable as follows: user interface express as a visualization of system that assist stakeholder (Trzuskawska et al. 2017; Mittlefehldt et al. 2019; Tharatipyakul et al. 2021; Saputra et al. 2022), system transparency explain as a direct information sharing across stakeholders related operational and financial process (Fulconis et al. 2018; Paliwal et al. 2020; Hellani et al. 2020; Patsavellas et al. 2021), implementation discomfort taking about discomfort response from stakeholders related visualization of this system (Nugroho et al. 2017; Parasuraman, 2000; Irannezhad, 2020) and infrastructure development explain as supporting tools that need to equipped the used of this system (Wang et al. 2019; Alacam et al. 2021; Sahoo et al. 2022). Another latent variable is Cost of Technologies which defined as all possible expenses that arise during the using of Blockchain and Control

Tower. Exogenous variable for Cost of Technologies have observed variable as follows: investment risk which explain as projection of benefit cost analysis regarding this developing this system (Kfoury, 2021; Alacam et al. 2021; Cichosz et al. 2020; Chowdhury et al. 2022), cost of training express as implementation cost to leverage user skills before use this system (Grover et al. 2019; Miraz et al. 2020; Choi et al. 2020; Mkansi, 2021) and cost of operations talking about cost of development and stakeholders once running in daily business (Treiblmaier, 2018; Liotine, 2019; Marbouh et al. 2020; Franceli et al. 2021).

In addition, exogeneous variables comes from Characters of Stakeholders which defined as behavior and method which arise from user point of view. Exogenous variable for Characters of Stakeholders have observed variable as follows: support from top management that talking about commitment that needed coming from leaders in each parties that involved (Sony et al. 2019; Nuryyev et al. 2020; Belinski et al. 2020; Çolak et al. 2022), organizations resistance express as potential response of discomfort behavior related transparency in operational or financial process (Cichosz et al. 2020; Balci et al. 2021; Baigy et al. 2022), organization size talking about potential of adjustment of team involvement based on requirement of this system (Agostini et al. 2019; Franceli et al. 2021; Nuryyev et al. 2020; Varriale et al. 2021) and the last one is government regulation express as transaction method which need to harmonized related blockchain scheme (Ahmad et al. 2020), (Min, 2019), (Syahchari et al. 2022). Moreover, Characters of User also become a part of this research variable which defined as mindset and response from user in daily activities. Exogenous variable for Characters of Users have observed variable as follows: implementation willingness express as internal response from user to support the use of this system (Queiroz et al. 2019; Patsavellas et al. 2021; Çolak et al. 2022), knowledge sharing talking about the ability of user to involved and share their understanding on this end to end process (Wu et al. 2017; Alacam et al. 2021), insecure behavior explain as discomfort response based on user mindset on initial implementation (Park et al. 2020; Baki et al. 2018; Çolak et al. 2022; Saputra et al. 2022), and the last observed variable was social influence which express as influence from user around that correlated to trusting level of this system (Saputra et al. 2022; Jung, 2022).

Furthermore, the latent variable which adopted from Technology Acceptance Model defined from Perceived Usefulness, Perceived Ease of Use and Intention to Use. There are 2 exogenous variables which are Perceived Usefulness talking about degree of user which have their belief of using this new particular system to increase their performance and Perceived Ease of Use that express as a degree satisfaction point of view regarding the potential use of new system. Moreover, the endogenous variable coming from Intention to Use which defined as a degree of user plans to use the new system on the following time period. Exogenous variables for Perceived Usefulness have observed variables as follows: Minimize obstacles, Supply Chain Effective, Supply Chain Productivity, Supply China Performance (Kamble et al. 2019). Exogenous variable for Perceived Ease of Use have observed variables as follows: Easy to Use, Understandable, Perform Task, Assisted Working (Kamble et al. 2019). And the endogenous variable for Intention to Use have observed variables as follows: Intention to Adopt, Predict for Implementation, and Plan to Use (Queiroz et al. 2019).

Based on Table 1 as explaining about research framework, researcher define research model and hypothesis to be used in this study. As mention in the operational variable, there are 8 latent variables with total of 30 observed variables to conduct an analysis of the potential application of Blockchain and Control Tower at Forwarding business in Indonesia. These hypotheses were construct in order to analyze the external factors under Technology Acceptance Model to asses the potential use of Blockchain and Control Tower. Those hypotheses will check whether that variables construct and influence the intention to use of Blockchain with Control Tower. Detail as follows :

1) H1: Supply Chain Issue (SCI) have a significant impact related to the Perceived Usefulness (PU) (Nuryyev et al. 2020; Jung, 2022; Chowdhury et al. 2022).
2) H2: Technology Readiness (TER) have significant impact related to the Perceived Usefulness (PU) (Nugroho et al. 2017; Kamble et al. 2019; Saputra et al. 2022).
3) H3: Character of Stakeholder (COS) have significant impact related to the Perceived Ease of Use (PEOU) (Wu et al. 2017; Kamble et al. 2019; Nuryyev et al. 2020).

4) H4: Character of Users (COU) have significant impact related to the Perceived Ease of Use (PEOU) (Wu et al. 2017; Kamble et al. 2019; Nuryyev et al. 2020).
5) H5: Cost of Technology (COT) have significant impact related to the Intention to Use (ITU) (Grover et al. 2019; Chowdhury et al. 2022).
6) H6: Perceived Ease of Use (PEOU) have significant impact related to the Perceived Usefulness (PU) (Wu et al. 2017; Kamble et al. 2019; Nuryyev et al. 2020).
7) H7: Perceived Usefulness (PU) have significant impact related to the Intention to Use (ITU) (Wu et al. 2017; Kamble et al. 2019; Saputra et al. 2022).
8) H8: Perceived Ease of Use (PEOU) have significant impact related to the Intention to Use (ITU) (Wu et al. 2017; Kamble et al. 2019; Saputra et al. 2022).

Based on the above hypothesis, the researcher conducts a research model which will be running with Smart-PLS Software as shown in the Figure 1. There will be sign with rectangle on Figure 1 to express an exogenous, an endogenous variables and hypothesis of this research study.

RESULTS

The result of this study that collected from 93 respondents started with analyzing the demographic of the respondent to know in deep about the participant's background. Table 2 express the demographic analysis which explain that 75.27% of the respondent is a Male and followed by Female by 24.73%. Furthermore, respondents based on age range based by 4 types which dominated by 38-44 years old by 31.18% and the last on 24-30 years old by 9.68%. Education level based comprised by 2 categories which dominated by bachelor (S1)/diploma (D3) by 79.57% and followed by master (S2) by 20.43%. And then, working experience comprised by 4 categories which leading on over than 18 years by 33.33% then followed on 13-18 years and 7-12 years by 30.11% and the last on 0-6 years by 6.45%.

In addition, company size divided by 4 categories and dominated in 20-200 employees by 48.39%, and then the last was 401-600 employees by 5.38%. Respondent based on capital type of company dominated on foreign capital by 67.74% then followed on domestic capital by 32.26%. Moreover, based on logistics services company dominated on forwarding business by 40.86%, followed on land transport by 32.26%, then consultant / IT development by 19.35%, and the last coming from sea transport by 7.53%. Finally, the last parameter divided from the type of department which are dominated in operational dept. by 56.99% and the last coming from procurement dept. by 2.15%.

Furthermore, all those 93 data from respondents were used to analyze for Confirmatory Factor Analysis with Smart-PLS software. The researcher found the result of the model fit to check the proper data according to the model based on research. Model Fit can be shown in Table 3 and this research study refers from SRMR is a Good Fit based result $0.075 < 0.08$, based on NFI refer a Moderate Fit based on result $0.769 < 0.9$, however result express that the Rms Theta categorized as Not Fit. Since there still have Good Fit, so it still can be used for the next further process.

Moreover, the next process is outer model assessment based on the validity and reliability of research variables. There are four criteria for assessing the outer model, namely the Validity of the model (Loading Factors), Construct Reliability, Cronbach's Alpha, and Convergent Validity (Average Variance Extracted). These values can be shown in Table 4.

Based on Table 4, all those outer loading factors have resulted in the range 0.7 – 0.9 and it's mean that all variables are constructed to build each factor since the result is ≥ 0.6. Construct Reliability ≥ 0.7 express the observed variable has a good to build the latent variable then Cronbach's Alpha ≥ 0.6 explain that observed variables are correct to be used to represent the latent variables. The last parameter are Average Variance Extract which express ≥ 0.5 to explain that the construct of latent variable is different from another latent variables.

As detailed in exogenous variables, the Characters of Stakeholders (COS), one observed variable (COS4) have to eliminate before continue to analyze the next process due to under threshold limit. On the other side, all the observed variables for others latent variables already meet the requirement of loading factors. Moreover, on the average, observed variables from Characters of Users (COU) have the highest results of loading factors compare to others observed variable.

Table 1. Detailed research framework

Latent Variable	Observed Variable	References
Supply Chain Issue (SCI)	Lack of Visibility (SCI1)	Wu et al. (2017); Kamble et al. (2019); Balci et al. (2021)
	Less Scalability (SCI2)	Hellani et al. (2020).Marbouh et al. (2020), Irannezhad, (2020), (Tseng et al. (2021); Kfoury, (2021); Jung (2022),
	Payment Delay (SCI3)	
	Ineffective Administration (SCI4)	Feyissa et al. (2019), (Keresztes et al. 2022), Patsavellas et al. (2021).
Technologies Readiness (TER)	User Interface (TER1)	Tharatipyakul et al. (2021), Saputra et al. (2022), Trzuskawska et al. (2017), Mittlefehldt et al. (2019).
	System Transparency (TER2)	Paliwal et al. (2020; Hellani et al. (2020), (Patsavellas et al. (2021; Fulconis et al. (2018).
	Implementation Discomfort (TER3)	Parasuraman (2000; Nugroho et al. (2017), Irannezhad (2020)
	Infrastructure Development (TER4)	Sahoo et al. (2022); Wang et al. (2019), Alacam et al. (2021).
Cost of Technologies (COT)	Investment Risk (COT1)	Chowdhury et al. (2022); Kfoury (2021); Alacam et al. (2021); Cichosz et al. (2020).
	Cost of Training (COT2)	Miraz et al. (2020), Grover et al. (2019), Choi et al. (2020), Mkansi (2021).
	Cost of Operations (COT3)	Treiblmaier, 2018; Marbouh et al. 2020; Treiblmaier, 2018; Franceli et al. (2021).
Characters of Stakeholders (COS)	Support Top Management (COS1)	Nuryyev et al. (2020), Sony et al. (2019), Belinski et al. (2020); Çolak et al. (2022)
	Organizations Resistance (COS2)	Baigy et al. (2022), Balci et al. (2021), Cichosz et al. (2020).
	Organization Size (COS3)	Nuryyev et al. (2020), Varriale et al. (2021), Agostini et al. (2019),Franceli et al. (2021).
	Government Regulation (COS4)	Min (2019); Ahmad et al. (2020); Syahchari et al. (2022)
Character of Users (COU)	Implementation Willingness (COU1)	Queiroz et al. (2019); Patsavellas et al. (2021); Çolak et al. (2022).
	Knowledge Sharing (COU2)	Wu et al. (2017); Alacam et al. (2021).
	Insecure Behavior (COU3)	Baki et al. (2018); Park et al. (2020); Saputra et al. (2022), Çolak et al. (2022).
	Social Influence (COU4)	Saputra et al. 2022; Jung, 2022)
Perceived Usefulness (PU)	Minimize Obstacles (PU1)	Kamble et al. (2019)
	Supply Chain Effectiveness (PU2)	Kamble et al. (2019)
	Supply Chain Productivity (PU3)	Kamble et al. (2019)
	Supply Chain Performance (PU4)	Kamble et al. (2019)
Perceived Ease of Use (PEOU)	Easy to Use (PEOU1)	Kamble et al. (2019)
	Understandable (PEOU2)	Kamble et al. (2019)
	Perform Task (PEOU3)	Kamble et al. (2019)
	Asisted Working (PEOU4)	Kamble et al. (2019)
Intention to Use (ITU)	Intent to Adopt (ITU1)	Queiroz et al. (2019)
	Predict for Implementation (ITU2)	Queiroz et al. (2019)
	Plan to Use (ITU3)	Queiroz et al. (2019)

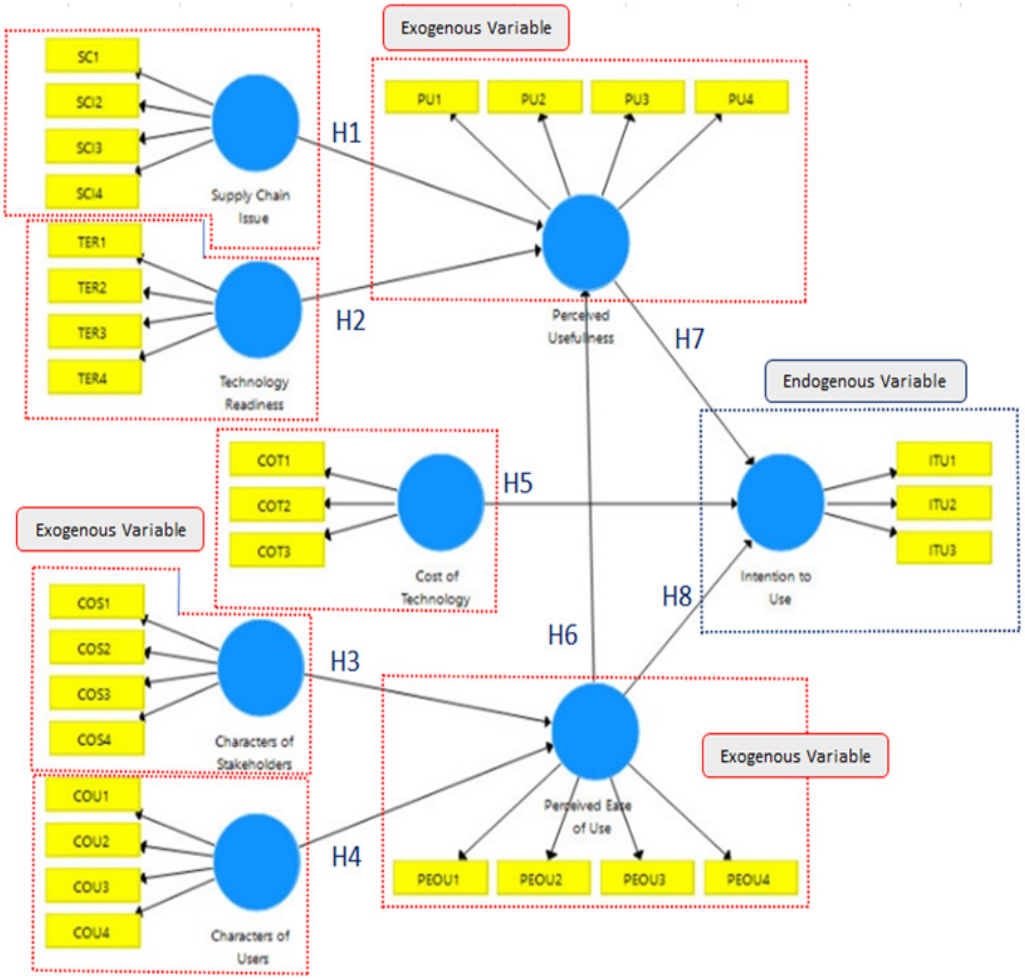

Figure 1. Research framework

Table 2. Demographic data questionnaire

Demographic Data	Number	Percentage
All Respondent	93	100%
Gender		
Male	70	75.27%
Female	23	24.73%
Age Range		
24-30 years old	9	9.68%
31-37 years old	27	29.03%
38-44 years old	29	31.18%
over than 44 years old	28	30.11%
Education Level		
Bachelor (S1)/Diploma (D3)	74	79.57%
Master (S2)	19	20.43%
Working Experience		
0-6 years	6	6.45%
7-12 years	28	30.11%
13-18 years	28	30.11%
over than 18 years	31	33.33%

Demographic Data	Number	Percentage
Company Size		
20-200 employees	45	48.39%
201-400 employees	16	17.20%
401-600 employees	5	5.38%
over than 600 employees	27	29.03%
Capital Type of Company		
PMDN (domestic capital)	30	32.26%
PMA (foreign capital)	63	67.74%
Type of Logistics Services		
Forwarding	38	40.86%
Land Transport (Truck/Train)	30	32.26%
Sea Transport (Vessel)	7	7.53%
Consultant / IT Development	18	19.35%
Type of Department		
Finance Division	14	15.05%
Operational / Transport	53	56.99%
Procurement	2	2.15%
Sales/Marketing	11	11.83%
Information Technology	13	13.98%

Table 3. Model fit result

Indicators	Estimated Model	Significant Level	Model Fit
SRMR	0.075[a]	0.08	Good Fit
NFI	0.769[b]	0.9	Moderate Fit
Rms Theta	0.242[c]	0.102	Not Fit

Note : p^a <0.08 ; p^b < 0.9 ; p^c > 0.102

Table 4. Outer model result

Variables	Loading Factors[1]	Construct Reliability[2]	Cronbach's Alpha[3]	Average Variance Extract[4]
Supply Chain Issue (SCI)				
SCI1	0.831	0.931	0.902	0.773
SCI2	0.877			
SCI3	0.907			
SCI4	0.900			
Technologies Readiness (TER)				
TER1	0.924	0.965	0.952	0.872
TER2	0.922			
TER3	0.951			
TER4	0.937			
Cost of Technologies (COT)				
COT1	0.834	0.925	0.877	0.804
COT2	0.926			
COT3	0.927			
Characters of Stakeholders (COS)				
COS1	0.866	0.894	0.833	0.739
COS2	0.813			
COS3	0.897			
COS4*	-0.125			
Characters of Users (COU)				
COU1	0.925	0.965	0.952	0.875
COU2	0.931			
COU3	0.950			
COU4	0.935			
Perceived Ease of Use (PEOU)				
PEOU1	0.784	0.863	0.815	0.611
PEOU2	0.817			
PEOU3	0.804			
PEOU4	0.718			
Perceived Usefulness (PU)				
PU1	0.833	0.932	0.902	0.773
PU2	0.872			
PU3	0.904			
PU4	0.906			
Intention to Use (ITU)				
ITU1	0.834	0.925	0.877	0.950
ITU2	0.926			
ITU3	0.927			

Note: [1] LF ≥ 0.6; [2] CR≥ 0.7; [3] CA ≥ 0.6; [4] AVE ≥ 0.5 ; * Eliminate

Moreover, the highest result of Construct Reliability belongs to Technologies Readiness (TER) and Characters of Users (COU) which are 0.965. On the contrary, the lowest result express from Perceived Ease of Use (PEOU) which is 0.863. Furthermore, the highest result of Cronbach's Alpha express from Technologies Readiness (TER) and Characters of Users (COU) which are 0.965. And then, the lowest result coming from Perceived Ease of Use (PEOU) which is 0.815. Furthermore, the highest Average Variance Extract (AVE) coming from Characters of Users which is 0.875 when the lowest coming from Perceived East of Use (PEOU) on the 0.611. In addition, an endogenous variable which belong to Intention to Use (ITU) has Construct Reliability 0.925, Cronbach's Alpha 0.877, and Average Variance Extract 0.950. All result based on running with PLS can take a look on the Figure 2.

The other indicator for an outer model is Discriminant Validity (HTMT) which is shown in Table 5. Those variables have HTMT score < 0.9 compared the others variable, means that there is no correlation of observed variable into the other latent variable and reliable to be used on this model to construct each latent variable and running the path analysis. Moreover, the researcher running with Smart PLS software and analyze the inner model. This inner model would like to determine the path coefficient and t-statistic for indicating the level of significance of changes in the exogenous variable on the endogenous variable. Patch coefficient will indicate as significant if P-values < significant level with used alpha 5%.

Figure 2. Result model with Smart-PLS

Based on Table 6, the model explained that SCI have a positive impact on PU since having p-value 0.000, COS has a positive impact on PEOU since having p-value 0.047, COU has a positive impact on PEOU since having p-value 0.000, COT has a positive impact on ITU since having p-value 0.000. Based on this outer indicator model, the researcher accepts the Hypothesis of H1, H3, H4, H5 which passed the criteria of the required test. Moreover, TER have no significant impact on PU since having p-value 0.328, PEOU have no significant impact on PU since having p-value 0.354, PU have no significant impact on ITU since having p-value N#A, PEOU have no significant impact on ITU since having p-value N#A. Based on this outer indicator model, the researcher rejects the Hypothesis of H2, H6, H7, H8 which not passed the criteria of the required test.

Based on result for the running data, this study can strengthen the previous research (Nuryyev et al. 2020 Jung, 2022; Chowdhury et al. 2022) which indicate the positive impact for Supply Chain Issue (SCI) into Perceived Usefulness (PU), this means that issue from operational or financial aspects will have direct positive impact to the point of view from Perceived Usefulness of Blockchain with Control Tower. Second, it also strengthens previous research (Wu et al. 2017; Kamble et al. 2019; Nuryyev et al. 2020) which indicate the positive impact for Characters of Stakeholders (COS) into Perceived Ease of Use (PEOU) this means that parties which involved in this forwarding business will have direct positive impact to the point of view from Perceived Ease of Use (PEOU) of Blockchain with Control Tower. Third, it also strengthens previous research (Wu et al. 2017; Kamble et al. 2019; Nuryyev et al. 2020) which indicate the positive impact for Characters of Users (COU) into Perceived Ease of Use (PEOU) this means users potential which involved in this forwarding business will have direct positive impact to the point of view from Perceived Ease of Use of Blockchain with Control Tower. Fourth, it also strengthens previous research (Grover et al. 2019; Chowdhury et al. 2022) which indicate the positive impact for Cost of Technologies (COT) into Intention to Use (ITU) this means cost of implementation Blockchain with Control Tower which could be arise in this forwarding business will have direct positive impact to the point of view from Intention to Use of Blockchain with Control Tower.

Table 5. Discriminant Validity (HTMT)

Variable	COS	COU	COT	ITU	PEOU	PU	SCI
Characters of Stakeholders (COS)							
Characters of Users (COU)	0.364						
Cost of Technologies (COT)	0.107	0.210					
Intention to Use (ITU)	0.107	0.210	1.140				
Perceived Ease of Use (PEOU)	0.376	0.611	0.174	0.174			
Perceived Usefulness (PU)	0.358	0.385	0.068	0.068	0.594		
Supply Chain Issue (SCI)	0.353	0.555	0.057	0.057	0.672	0.818	
Technologies Readiness (TER)	0.142	0.086	0.125	0.125	0.110	0.103	0.198

Table 6. Patch analysis (total effect)

Indicator	Original Sample	P-Value	Sig. Level	Significant
SCI → PU	0.685	0.000	0.05	YES
TER → PU	-0.032	0.328	0.05	NO
COS → PEOU	0.148	0.047	0.05	YES
COU → PEOU	0.651	0.000	0.05	YES
COT → ITU	1.000	0.000	0.05	YES
PEOU → PU	0.101	0.354	0.05	NO
PU → ITU	0.000	N#A	0.05	NO
PEOU → ITU	0.000	N#A	0.05	NO

Furthermore, there are some limitations in this study that can create opportunities to conduct more further research regarding this topic. First, it could be good to have the same industries that served by respondent from forwarding business to make a better focus of analysis related this framework. In this research, respondents coming from forwarding with diverse industry and can make some cross conditional conditions of the result. Second, this study can also extend into the case of international forwarding that served from Indonesia. It could be having the different perspective from respondent in this forwarding business that focus on domestic or international forwarding.

Managerial Implications

This study increases understanding from stakeholders in forwarding business to take aware to the following aspects, Supply Chain Issue, Technology Readiness, Cost of Technology, Characters of Stakeholders, and Characters of Users. These aspects can influence the successful potential use of Blockchain with Control Tower to domestics forwarding business at Indonesia. On the rapid growth of business, forwarder should propose some innovative solutions that can express through the use of Blockchain integrated to Control Tower for have a comprehensive monitoring on end-to-end supply chain business.

Moreover, this study also provides knowledge of higher impact either from Purposed Usefulness or Perceived Ease of Use to influenced the intention use of Blockchain with Control Tower. It means some forwarder which served in domestic business can be focus to with attentions on these aspects before going forward to implement scheme Blockchain with Control Tower.

Furthermore, this study can provide some point of view related one of the solutions on the forwarding business which can have impact to all stakeholders. It can be a good scheme to support of improving supply chain performance and reduce some undesired process within end-to-end forwarding activities. This solution can also enhance customer satisfaction, improve cross functional collaboration and tailor as a good impact to whom that involved in this future model of domestic forwarding business in Indonesia.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This study purposed to identify of the potential application of Blockchain and Control Tower based on user's acceptance level under Technology Acceptance Model (TAM). Researcher defined external variables under TAM model that have influence to Perceived Usefulness, Perceived Ease of Use and Intention to Use. Based on this result of this study, the researcher accepts the Hypothesis of H1, H3, H4, H5. Meanwhile rejects the Hypothesis of H2, H6, H7, H8 which not passed the criteria of the required test.

The acceptance of hypothesis expresses that H1- Supply Chain Issue (SCI), H3-Characters of Stakeholders (COS), H4-Characters of Users (COU), H5-Cost of Technology (COT) have significance impact into other latent variables. This condition-based situation that respondent take concern for some process which arise obstacles during the daily activities and need to solve with Blockchain and Control Tower scheme. Meanwhile, this study also explain that respondent take concern with condition coming from people in this process which coming from Characters of Stakeholders and Characters of Users. Moreover, the investment cost that represent from Cost of Technology also being a concern based on this study due to have prepare proper calculation before implement this potential solution.

The rejection of hypothesis express that H2-Technologies Readiness (TER), H6-Perceived Ease of Use (PEOU), H7 & H8- Perceived Usefulness (PU) not have significance impact to influence into other latent variables. This condition-based situation that respondent take concern with the preparation this technology scheme in Indonesia which need some proper preparation. This situation aligned that Blockchain and Control Tower not yet implemented and make some respondent put some concern with this variable and the result of analysis make a rejection of this hypothesis. Moreover, the respondent also still not have a good point of view related the Perceived Ease of Use and Perceived Usefulness related this technology scheme. This can be understood and also express from the result of this study which rejection of this hypothesis.

Blockchain with Control Tower is providing a dashboard monitoring to be used for all parties on the supply chain model regarding financial and operational side accordingly based on the contract agreed. This study explain that latent variables constructed external variables which influence on the Technology Acceptance Model (TAM) predictor. The influence of these external variables can notice to stakeholders for taking concern about those aspects. The potential used of Blockchain with Control Tower will enhance a competitive advantage for domestic forwarder into their consumers through a comprehensive solution on the financial and operational aspects with of performance monitoring via dashboard.

Recommendations

The study acknowledge has several limitations. Furthermore, it could be great to develop in further research with considerations of respondent that coming only from forwarding business activity, meanwhile on current study, it coming from several type of business on supply chain. This can be having a more precisely result and feedback regarding the potential use of Blockchain and Control Tower on the logistics forwarding business. Respondent could be having the similar perspective according to the several factors that influence for the potential implementation of Blockchain and Control Tower scheme. This condition will also reduce biases from the questionnaire result due to have the same point of view.

The other consideration is to extend the scope of business from the international forwarding and not only from domestic side. The current respondent only taking a perspective factor which influence from the domestic area. Further research could be design with respondent that coming from international forwarding in order to broader result of the point of view for potential use Blockchain and Control Tower on the forwarding scope of business. This condition will enlarge the factor analysis and added other factors will possibly influence the potential scheme of Blockchain and Control Tower.

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REFERENCES

Agostini L et al. 2019. Organizational and managerial challenges in the path toward Industry 4.0. *European Journal of Innovation Management* 22(3):406–421. https://doi.org/10.1108/EJIM-02-2018-0030

Ahmad A et al. 2020. The role of perceived benefits and perceived risks towards the consumers purchase intention via e-commerce: an evidence from indonesia. product development in islamic book publication industry: a case of Pustaka Salam Sdn. *Bhd View project DAMPAK* 63(2s):3257–3274. https://doi.org/10.13140/RG.2.2.25619.63527

Al-Aulamie A. 2013. Enhanced technology acceptance model to explain and predict learners behavioural intentions in learning management systems [Dissertation]. University of Bedfordshire.

Alacam S et al. 2021. Using blockchain technology to foster collaboration among shippers and carriers in the trucking industry: a design science research approach. *Logistics* 5(2):1–24. https://doi.org/10.3390/logistics5020037

Babulak E et al. 2019. Logistical control for consumer satisfaction in a global society. *The Advances in Information Sciences and Service Sciences (AISS)* 11(1): 30–35.

Baigy E et al. 2022. Innovation adoption case study and the potential of Blockchain on Trade Single Window [Thesis]. Uppsala Universitet.

Baki R et al. 2018. A meta analysis of factors affecting perceived usefulness and perceived ease of use in the adoption of E-Learning systems. *Turkish Online Journal of Distance Education* 19(4):4–42. https://doi.org/10.17718/tojde.471649

Balci G et al. 2021. Blockchain adoption in the maritime supply chain: Examining barriers and salient stakeholders in containerized international trade. *Transportation Research Part E: Logistics and Transportation Review* 156:1–17. https://doi.org/10.1016/j.tre.2021.102539

Belinski R et al. 2020. Organizational learning and Industry 4.0: findings from a systematic literature review and research agenda. *Benchmarking* 27(8):2435–2457. https://doi.org/10.1108/BIJ-04-2020-0158

Choi D et al. 2020. Factors affecting organizations resistance to the adoption of blockchain technology in supply networks. *Sustainability* 12(21):1–37.https://doi.org/10.3390/su12218882

Chowdhury S et al. 2022. Blockchain technology adoption for managing risks in operations and supply chain management: evidence from the UK. *Annals of Operations Research* 2022:1–35. https://doi.org/10.1007/s10479-021-04487-1

Cichosz M et al. 2020. Digital transformation at logistics service providers: barriers, success factors and leading practices. *International Journal of Logistcs Management* 31(2): 209–238. https://doi.org/10.1108/IJLM-08-2019-0229

Çolak H et al. 2022. Acceptance of blockchain technology in supply chains: a model proposal. *Operations and Supply Chain Management* 15(1):17–26. https://doi.org/10.31387/oscm0480327

Dubey S et al. 2020. Brief Study of Value Chain and Supply Chain. Brief Study of Value Chain and Supply Chain, (September) :177–183.

Feyissa T et al. 2019. The impact of the core company's strategy on the dimensions of supply chain integration. *International Journal of Logistics Management* 30(1):231–260. https://doi.org/10.1108/IJLM-03-2017-0080

Franceli J et al. 2021. Adoption factors of enabling I4.0 technologies and benefits in the supply chain. *Computer Science and Technology* 2021: 81–96. https://doi.org/10.5121/csit.2021.110908

Fulconis F et al. 2018. Supply chain monitoring: LLPS and 4PL providers as orchestrators. *Procedia - Social and Behavioral Sciences* 238:9–18. https://doi.org/10.1016/j.sbspro.2018.03.002

Grover P et al. 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 JF et al. 2014. Partial least squares structural equation modeling (PLS-SEM): An emerging tool in business research. *European Business Review* 26(2):106–121. https://doi.org/10.1108/EBR-10-2013-0128

Hellani H et al. 2020. Overview on the blockchain-based supply chain systematics and their scalability tools. *Emerging Science Journal* 4 (Special Issue):45–69. https://doi.org/10.28991/esj-2021-SP1-04

Irannezhad E. 2020. The architectural design requirements of a blockchain-based port community system. *Logistics* 4(4):1–31. https://doi.org/10.3390/logistics4040030.

Jameson J et al. 2022. A systematic review and framework for digital leadership research maturity in higher education. *Computers and Education Open* 3(Oct):100115.https://doi.org/10.1016/j.caeo.2022.100115

Jung D H. 2022. Enhancing competitive capabilities of healthcare SCM through the blockchain: big data business model's viewpoint. *Sustainability* 14(8):1–17.https://doi.org/10.3390/su14084815

Kamble S et al. 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

Keresztes É R et al. 2022. Exploratory Analysis of blockchain platforms in supply chain management. *Economies* 10(9): 206. https://doi.org/10.3390/economies10090206

Kfoury B. 2021. The role of blockchain in reducing the cost of financial transactions in the retail industry. *CEUR Workshop Proceedings* 2889:10–22.

Lai P. 2017. The literature review of technology adoption models and theories for the novelty technolog. *Journal of Information Systems and Technology Management* 14(1):1–38. https://doi.org/10.4301/s1807-17752017000100002

Liotine M. 2019. Shaping the next generation pharmaceutical supply chain control tower with autonomous intelligence. *Journal of Autonomous Intelligence* 2(1):56–71. https://doi.org/10.32629/jai.v2i1.34

Marbouh D et al. 2020. Blockchain for covid-19: review, opportunities, and a trusted tracking system. *Arabian Journal for Science and Engineering* 45(12): 9895–9911. Doi: 10.1007/s13369-020-04950-4

Merkx M. 2019. VAT and blockchain: Challenges and opportunities ahead. *EC Tax Review* 28(2):83–89. https://doi.org/10.54648/ecta2019011

Min H. 2019. Blockchain technology for enhancing supply chain resilience. *Business Horizons* 62(1): 35–45. https://doi.org/10.1016/j.bushor.2018.08.012

Miraz M H et al. 2020. Factors affecting implementation of blockchain in retail market in Malaysia. *International Journal of Supply Chain Management* 9(1):385–391.

Miroglio D 2013. *Control Towers For The Pharmaceutical Supply Chains*. Paris: Altran Consulting.

Mittlefehldt B et al. 2019. Supply chain control tower:

the information link for operations across the live enterprise. *Deloite Issue* 10/2019: 7.

Mkansi M. 2021. *E-Business Adoption Costs And Strategies For Retail Micro Businesses.* Berlin, Jerman: Electronic Commerce Research Springer US. https://doi.org/ 10.1007/s10660-020-09448-7

Moin S et al. 2019. Securing IoTs in distributed blockchain: Analysis, requirements and open issues. *Future Generation Computer Systems* 100:325–343.https://doi.org/10.1016/j.future.2019.05.023

Nugroho MA et al. 2017. Effects of technology readiness towards acceptance of mandatory web-based attendance system. *Procedia Computer Science* 124:319–328. https://doi.org/10.1016/j.procs.2017.12.161

Nuryyev G et al. 2020. Blockchain technology adoption behavior and sustainability of the business in tourism and hospitality SMEs: An empirical study. *Sustainability* 12(3):1–21. https://doi.org/10.3390/su12031256

Paliwal V et al. 2020. Blockchain technology for sustainable supply chain management: A systematic literature review and a classification framework. *Sustainability* 12(18):1–39. https://doi.org/10.3390/su12187638

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

Park E S et al. 2020. Factors of the technology acceptance model for construction IT. *Applied Sciences* 10(22):1–15. https://doi.org/10.3390/app10228299

Patsavellas J et al. 2021. Supply chain control towers: Technology push or market pull an assessment tool. *IET Collaborative Intelligent Manufacturing* 3(3):290–302. https://doi.org/10.1049/cim2.12040

Queiroz M et al. 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

Sahoo S et al. 2022. *Blockchain For Sustainable Supply Chain Management: Trends And Ways Forward.* Berlin, Jerman: Electronic Commerce Research Springer US. https://doi.org/10.1007/s10660-022-09569-1

Saputra U et al. 2022. The intention to use blockchain in Indonesia using extended approach technology acceptance model (TAM). *CommIT Journal* 16(1):27–35. https://doi.org/10.21512/commit.v16i1.7609

Sciarelli M et al. 2022. Factors affecting the adoption of blockchain technology in innovative Italian companies: an extended TAM approach. *Journal of Strategy and Management* 15(3):495–507. https://doi.org/10.1108/JSMA-02-2021-0054

Sony M. 2019. Key ingredients for evaluating Industry 4.0 readiness for organizations: a literature review. *Benchmarking International Journal* 27(7): 2213–2232. https://doi.org/10.1108/BIJ-09-2018-0284

Surendran P. 2013. Technology acceptance model: a survey of literature. *International Journal of Business and Social Research* 2(4): 175–178. https://doi.org/10.18533/ijbsr.v2i4.161

Syahchari D H et al. 2022. Achieving Supply Chain Resilience Through Supply Chain Control Tower And Supply Chain Agility. *ACM International Conference Proceeding Series (January)*: 195–198. https://doi.org/10.1145/3512676.3512709

Taherdoost H. 2016. Sampling Methods in Research Methodology; How to Choose a Sampling Technique for Research Methodology. *International Journal of Academic Research in Management (IJARM)* 5(2):18–27. https://doi.org/10.2139/ssrn.3205035

Tharatipyakul A. 2021. User Interface of Blockchain-Based Agri-Food Traceability Applications: A Review. *IEEE Access* 9:82909–82929. https://doi.org/10.1109/ACCESS.2021.3085982

Treiblmaier H. 2018. The impact of the blockchain on the supply chain: a theory based research framework and a call for action. *Supply Chain Management* 23(6):545–559. https://doi.org/10.1108/SCM-01-2018-0029

Trzuskawska G A. 2017. Control towers in supply chain management– past and future. *Journal of Economics and Management* 27(1):114–133. https://doi.org/10.22367/jem.2017.27.07

Tseng M L et al. 2021. Comparing world regional sustainable supply chain finance using big data analytics: a bibliometric analysis. *Industrial Management and Data Systems* 121(3):657–700. https://doi.org/10.1108/IMDS-09-2020-0521

Varriale V et al. 2021. New organizational changes with blockchain: a focus on the supply chain. J*ournal of Organizational Change Management*

34(2):420–438. https://doi.org/10.1108/JOCM-08-2020-0249

Wang Y et al. 2019. Understanding blockchain technology for future supply chains: a systematic literature review and research agenda. *Supply Chain Management* 24(1):62–84. https://doi.org/10.1108/SCM-03-2018-0148

Wu H et al. 2017. A distributed ledger for supply chain physical distribution visibility. *Information* 8(4):1–18. https://doi.org/10.3390/info8040137