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The Acceptance of the Application of Blockchain Technology in the Supply Chain Process of the Thai Automotive Industry

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ABSTRACT

Blockchain technology is an optional new technologies to manage the supply chain process. This technology helps to improve and solve the issue of transparency as well as monitor operations in the supply chain. The study found that the perceived benefits of Blockchain technology in the automotive industry, inter-organizational trust are the important factors that affect the acceptance of Blockchain in the supply chain process. Inter-organizational relationship has negative impact on Blockchain technology acceptance. The non-mediated power is a key factor that builds inter-organizational trust and leads to success in the technology application in this industry. The results can be used as a guideline for the automotive industry to apply Blockchain technologies to the operations.

Keywords: Blockchain, Supply Chain, Automotive Industry

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INTRODUCTION

The Thai automotive industry is the country's dominant industry from the past to the present, in particular the auto-parts manufacturing industry that has grown steadily. This makes automakers and car-related business, such as auto-parts manufacturers and car dealers need to adjust their marketing strategies to accommodate the needs of the auto market in each category and build trust in the quality of their cars to consumers. Therefore, the effective supply chain management of the automotive industry is very important for creating competitive opportunities. The effective management requires good cooperation from organizations involved from raw material supply to product delivery to consumers. Each process requires an exchange of information among stakeholders, for example the underlying data of the parts used in the production process (Drawing), the requirements for the automotive parts manufacture (Part Specification), and the documents regarding the standard of how to test a prototype before entering the production line (Standard Engineering). Generally, the process of an exchange of information relating to the production is done by automakers and the first tier supplier of automotive parts only. If the second tier supplier of automotive parts wants the information from the automaker for reference, the second tier supplier has to ask the automaker for the information or documents on the standards through the first tier supplier only. As abovementioned, it can be seen that an exchange of information among organizations still lacks equality in terms of acquiring the benefits from the process. It is also found that the first tier supplier benefits the most because it obtains the information from both the automaker and the second tier supplier of automotive parts. Therefore, trust building between automotive parts manufacturers and automakers will result in an exchange of mutually useful information (Corsten & Felde, 2005). In case of personal data or sensitive information, organizations should not trust and give the information to the third party because it is at risk to be attacked and could be misused. Consequently, organizations owning those data need to control their information for the safety or should limit the ability of the third party and staff to access those critical data (Zyskind & Nathan, 2015).

Nowadays, Blockchain technology is being discussed significantly with respect to the integration of systems among organizations to create transparency and build trust in their transactions. Blockchain is actually adopted for the first time in the financial industry as the basis for digital currencies (Cryptocurrency) such as Bitcoin (Nakamoto, 2008), which is a Peer-to-Peer transaction and changes a business model of industries having the distributed database. Blockchain is the technology that makes the various information can be systematically linked to each other without an intermediary. This technology is also beneficial in the matter of trust, information sharing and privacy (Zhao *et al.*, 2016), even if transaction partners are never known. These are the highlights of Blockchain. At present, Blockchain is likely to be widely applied in various industries, the manufacturing industry included, so all parts of the supply chain are reliable and can be monitored. As a result, the use of Blockchain in the supply chain process will help all stakeholders can share information and monitor the accuracy of the occurring transactions including the manufacturing process, the shipment, and the delivery of the products to consumers. Moreover, it helps to accelerate the process and make recording transactions in the supply chain process become more effective and reliable (Apte & Petrovsky, 2016). For the automotive industry, automotive parts manufacturers have invested in research and development about the organization's innovation. Due to the increasing current innovations and pressures on production costs, they have to find means to avoid unnecessary expenses (Ili *et al.*, 2010). In addition to helping to build trust, the application of Blockchain technology in the supply chain process can help to reduce the costs of corporate transactions and to prevent fraud as well.

LITERATURE REVIEW

The research in the past suggests that cooperative relationships in the supply chain among stakeholders will allow organizations to use resources effectively and help to improve the performance of organizations. Therefore, many organizations manage the relationship in the supply chain by using the Internet and modern and more complex information technologies that make the creation of linkage of electronic information for an exchange between organizations and business partners become better (Daft, 2006). Thus, the organizations must consider the needs of our business partners in terms of the acceptance of this technology. This not only helps to create success in doing business but also helps to build relationships of the technology application among organizations in order to increase the effectiveness of the supply chain process (Lin & Lin, 2014). Good cooperation among business partners in the supply chain will increase effectiveness in operations (Salam & Salam, 2017), and the information technology is also critical and has a role in increasing the effectiveness of the supply chain process (Singh & Teng, 2016). Accordingly, when designing a system for the supply chain process having the integration of organizations in the digital age, it is necessary to take the various needs of business stakeholders and functions that support the operation of the related systems. Accepting the technology of business partners not only helps to build success in doing business but also helps to build relationship of the integrated technology application among organizations in order to increase the effectiveness of the supply chain, and Blockchain technology is a new technological option for the supply chain management (Korpela *et al*, 2017). Blockchain can help to reduce costs and control all operations done under the same rules and standards, and all transactions can be made in real-time and transparent. It can lead to an increase in competitiveness of the organizations. Therefore, with the property of transparency, Blockchain technology can work well in a business that has many transactions, for instance financial services, supply chain management, services of government agencies, etc. (Siba & Prakash, 2017)

Moreover, the research in the past also shows that, in the matter of the application of new technologies for the supply chain process, the power among organizations is a factor that influences the collaboration. The power can be divided into two types: mediated power and non-mediated power (Zhao *et al*, 2008). The study also found that non-mediated power can make organizations accept new technologies and realize opportunities to make benefits to organizations (Liu *et al*, 2015). The relationship of the power among the business partners will build trust among organizations (Ke *et al*, 2009) and receive the support from the senior management, which is one of key factors for the acceptance of innovative application in organizations. The strategy from the executives will increase awareness of the potential benefits to staff concerned in organizations. The use of electronic data exchange system among organizations will mostly affect factories or organizations. The awareness of benefits is an important push factor for accepting the integration of information technology among organizations (Narayanan *et al*, 2009). Consequently, it is imperative that organizations need to improve the methods to utilize technological tools to benefit them. The technological acceptance is a key factor in adding value to their organizations. It also results in the integration of the supply chain process (De Mattos & Laurindo, 2017). Understanding the characteristics of the relationship among organizations can lead to the better acceptance of business cooperation in the supply chain. Hence, business partners can focus on improving the inter-organization relationship, such as creating a long-term relationship, willingness to share information with business partners, and improving mutual communications and working together (Chong *et al*, 2013).

In Thailand, Blockchain technology might has not been widely applied, so the objective of this study is to develop and test hypotheses related to factors affecting the acceptance of technology application in the supply chain process of the automotive industry in the country. This study also aims to predict a tendency of adoption of Blockchain in the supply chain process in terms of automakers and automotive parts manufacturers. The reason why the Thai automotive industry is chosen to study is because the automotive industry is considered as an indicator of economic prosperity, and the studies in the past regarding the supply chain in the automotive industry are reliable and well recognized. Furthermore, the automotive industry is a leading industry in the matter of strategic implementation on the supply chain management in the country (Boon-itt & Paul, 2008).

Conceptual Framework

The research in the past found that mediated power and non-mediated power affect the inter-organizational trust (Liu *et al*, 2015; Ke *et al*, 2009; Chae *et al*, 2017). Moreover the inter-organizational trust has an effect on inter-organizational relationship (Singh & Teng, 2016). The IT assimilation consisted of three components: relational mechanism, organization pressure and organization inertia would affect the inter-organizational relationship (Bala & Venkatesh, 2007). Factors influencing intention to adopt Blockchain in supply chain process include inter-organizational trust, inter-organizational relationship and perceived benefit of Blockchain technology. Furthermore, perceived benefit of Blockchain technology also affected inter-organizational relationship (Figure 1).

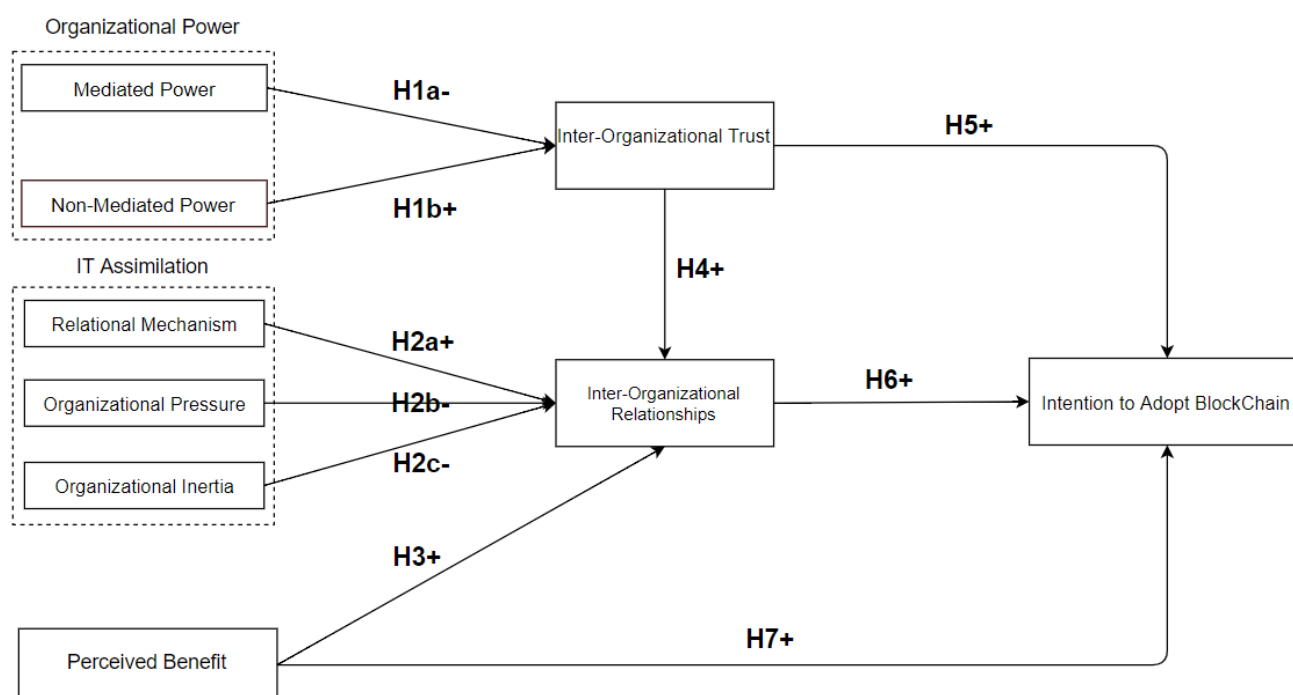


Figure 1: Conceptual Framework

METHODOLOGY

Research Instrument

The questionnaire is used as a tool for collecting data. The data collection is done by the questionnaire distribution directly to the samples and the electronic questionnaire. The questionnaire is divided into two sections including factors for the acceptance of the Blockchain technology in the supply chain process of the automotive industry. The questionnaire is measured by a 5-point Likert scale (5 - Strongly Agree, 1 - Strongly Disagree). The other part is the personal information of respondents, such as gender, age, education, type of organization, position, and information technology using behavior among organizations. Questionnaire was pretested to analyze the reliability.

Selection of Respondents

Purposive sampling was applied to select and interview the targeted respondents who are in the automotive supply chain. The target samples are executives and practical staff from the first tier suppliers of automotive parts and automotive assembly companies. The samples have to work in the departments that require interaction among organizations and have experience in utilizing information technology among organizations, for example sales, procurement, information technology, and engineering. About 385 survey questionnaires were distributed and 261 samples responded the questionnaire, which represents 67.79%.

DATA ANALYSIS

The measurement items of the constructs were examined by factor analysis, using Varimax rotation. The analysis results are presented in Table 1. The factors and their composition were identical to the literature review. Thus, the measurement instruments show adequate construct and discriminant validity.

The reliability of the measurement items was high. The Cronbach's alpha for all factors in this study exceeded 0.7. Table 2 presents the Cronbach's Alpha of the factors.

Table 1: Factor Analysis

Construct	Item Description	Factor Loading
Perceived Benefits of Blockchain technology	P2Q1PCB1	0.851
	P2Q1PCB2	0.815
	P2Q1PCB3	0.804
	P2Q1PCB4	0.736
	P2Q1PCB5	0.798
	P2Q1PCB6	0.821
	P2Q1PCB7	0.813
Relational Mechanism	P2Q2RLM1	0.768
	P2Q2RLM2	0.867
	P2Q2RLM3	0.877

Organizational Pressure	P2Q2OGP1	0.896
	P2Q2OGP2	0.875
	P2Q2OGP3	0.821
Organizational Inertia	P2Q2OGI1	0.804
	P2Q2OGI2	0.821
	P2Q2OGI3	0.763
Inter-Organizational Trust	P2Q3IOT1	0.893
	P2Q3IOT2	0.926
	P2Q3IOT3	0.840
Inter-Organizational Relationship	P2Q4IOR1	0.775
	P2Q4IOR2	0.911
	P2Q4IOR3	0.905
Intention to Adopt Blockchain in Supply Chain Process	P2Q5IAB1	0.936
	P2Q5IAB2	0.965
	P2Q5IAB3	0.959
Mediated Power	P2Q6MDP1	0.849
	P2Q6MDP2	0.908
	P2Q6MDP3	0.879
Non-Mediated Power	P2Q7NMP1	0.713
	P2Q7NMP2	0.869
	P2Q7NMP3	0.904

Table 2: Reliability Test Result

Construct	Cronbach's Alpha Coefficient
Perceived Benefits of Blockchain Technology	0.909
Relational Mechanism	0.788
Organizational Pressure	0.830
Organizational Inertia	0.710
Inter-Organizational Trust	0.864
Inter-Organizational Relationship	0.831
Intention to Adopt Blockchain in Supply Chain Process	0.950
Mediated Power	0.888
Non-Mediated Power	0.835

Multiple Regression was used to analyze the relationship of the Blockchain technology acceptance model. The results showed that non-mediated power has major impact on building inter-organization trust. Mediated power has no impact on inter-organization trust (Table 3).

Table 3: Regression analysis result testing the effect of inter-organization trust

Variable	Standardized Coefficients	t	Sig.
Mediated Power	0.104	1.749	0.082
Non-Mediated Power	0.518	8.683	0.000*

**p-value* < 0.05

The study found that the inter-organizational trust and organization inertia have major impact on enhancing inter-organizational relationship (Table 4). Finally, factors that have highest impact on acceptance of the Blockchain technology application in the supply chain process of the Thai automotive industry are perceived benefits of Blockchain technology of the personnel in the industry (Table 5). Inter-Organizational Trust also has impact on acceptance. However, Inter-Organizational Relationship has negative impact on acceptance (Table 5).

Table 4: Regression analysis result testing the effect of inter-organization relationship

Variable	Standardized Coefficients	t	Sig.
	Beta		
Perceived Benefits of Blockchain Technology	0.065	0.774	0.440
Relational Mechanism	-0.031	-0.400	0.689
Organizational Pressure	-0.116	-1.498	0.138
Organizational Inertia	0.358	5.189	0.000*
Inter-Organizational Trust	0.419	6.363	0.000*

*p-value < 0.05

Table 5: Regression analysis result testing the effect of intention to adopt Blockchain in supply chain process

Factor	Standardized Coefficients	t	Sig.
Perceived Benefits of Blockchain Technology	0.501	7.443	0.000*
Inter-Organizational Trust	0.184	2.441	0.016*
Inter-Organizational Relationship	-0.183	-2.550	0.012*

*p-value < 0.05

CONCLUSION

The study showed that perceived benefit and inter-organizational trust are critical factors that significantly affect the acceptance of Blockchain technology application in the supply chain process of Thai automotive industry. The non-mediated power is an important factor that makes the application of Blockchain technology in the automotive industry successful through the trust among organizations. Inter-organizational trust and organization inertia play the major roles on enhancing inter-organizational relationship. Surprisingly, inter-organizational relationship has negative impact on Blockchain technology acceptance. The effective supply chain process management of Blockchain adoption in the automotive industry requires good cooperation between organizations that are involved in processes from the procurement of raw materials to the delivery of products to consumers. Therefore, in the design of the Blockchain technology system for the supply chain process in the digital age integrating among organizations, automotive parts manufacturers and automakers must take the needs of different stakeholders and the nature of operating systems involved into consideration. This research studied the tendency to accept the application of Blockchain technology of the organizations only, so it should be a study on the perspective of consumers who are directly related to the products from the supply chain process in the future. It is particularly important to consumers to perceive the information on the products from the raw materials supplying process to the product delivery to customers. The results of this study can be a guideline for organizations involved with the automotive industry to apply Blockchain technologies to the organization operations and make them acquire the influential factors that affect the acceptance of the Blockchain technology application of the Thai automotive industry.

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