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Trust-Building Framework for Blockchain Technology Adoption: The Moderating Role of Quality Practices

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Abstract

This paper presents a conceptual framework to explore the effect of trust in determining the adoption intention of blockchain technology in organizations. To strengthen the arguments on the role of trust in the adoption of blockchain technology, a research model grounded in the diffusion of innovation theory and the trust-building framework is proposed based on a review of an extensive literature. This study will be conducted using an online survey questionnaire. The study findings are expected to support businesses, industry practitioners and the policymakers in gaining insights into the role of trust and utilizing it to promote the adoption of blockchain technology among organizations. From the theoretical side, this study will contribute to the IS body of knowledge on trust determinants and blockchain technology adoption. On the practical side, this study provides insight for public policy makers and organizations to understand key factors affecting blockchain technology adoption.

Keywords blockchain technology, trust-building, adoption, quality practices, diffusion of innovation

1 Introduction

Blockchain technology is a decentralized digital ledger with a growing list of records called blocks, which contain time-stamp data, cryptographic information and transaction details (Olnes et al. 2017). Blockchain technology offers several important benefits to organizations, which include removing intermediaries in the supply chain and allows suppliers to establish direct contact with their customers (Zhang et al. 2019). Recent studies acknowledge the potential of blockchain technology, and the importance given by the organizations due to its support in enabling authentication mechanism for trusted and secure online transactions (Olnes et al. 2017; Yli-Huumo et al. 2016).

Even though there is a rapid growth in the development of blockchain technology, there is a lack of trust in the use of this blockchain technology (Zhang et al. 2019). Given the significance of trust, how to build trust in the use of blockchain technology has become a critical aspect. Over the years, scholars have investigated the key determinants of trust in technology adoption from various academic perspectives. One area of study converges on the consumer market perspective (Xin et al. 2015; Zhang et al. 2019), another area of study attempts to approach trust from the technical perspective of the technology (Lin et al. 2014; Yli-Huumo et al. 2016); and a few other studies concentrated on the security and regulatory protection factors (Olnes et al. 2017; Zhang et al. 2019).

Previous studies provide useful information in understanding trust in technology adoption. They, however, have not considered the effect of quality practices towards trust of the blockchain technology. Cronin et al. (2000) point out that quality has been a core factor of differentiation to those organizations offering their products and services in an increasingly competitive environment. Meanwhile, Shao et al. (2019) reveal that high quality practices and transparency of the technology have a positive impact on the adoption and continuance intentions of the consumers.

This research attempts to answer the following research questions: *What should organizations do to build consumers' trust in the adoption of blockchain technology? Are there any behavioral differences in quality practices when promoting trust in the blockchain technology?* The objectives of this study are two-fold. First, this research attempts to investigate the factors for building trust in the adoption of blockchain technology. Second, this research attempts to understand the role of quality practices in promoting trust. There is a limited insight into the role of trust and the moderating role of quality practices in blockchain technology adoption intention. The findings of this research are expected to offer insights into the blockchain technology adoption intention through a trust lens. This will also help the practitioners to adopt an appropriate mechanism for a successful blockchain technology adoption.

The paper is organized into five sections. Section two reviews the existing research on blockchain technology, the impact of quality practices on trust and diffusion of innovation theory. Section three presents the proposed research model and hypotheses. Section four describes the proposed methodology and future work. Section five concludes the paper with expected contributions to the research.

2 Literature Review

2.1 Trust in Blockchain Technology

Gefen et al. (2003) believe that trust is the subjective belief in the character, ability, reliability, honesty or truth of someone. A number of studies have been conducted to investigate the effects of trust on technology adoption (Gefen et al. 2003; McKnight et al. 2002; Xin et al. 2015). McKnight et al. (2002) believe that trust plays a key role in helping consumers overcome perceptions of risk and insecurity. Xin et al. (2015) and Lin et al. (2014) present evidence to argue that customers' behavioral intention in using online system can be influenced by trust. These studies indicate that the greater the trust customers have in the service organizations offer, the higher the positive mindset towards intention to use the technology (Gefen et al. 2003).

In terms of blockchain technology, 'trust refers to the reliability of information provided by vendors/trading partners, or the safety and security of the data managed by a central authority (Olnes et al. 2017). Trust also influences the risks associated with the adoption of blockchain technology. Marriott and Williams (2018) explain that the optimum level of trust can facilitate participative decision-making and help develop successful solutions to address complex problems. It is therefore important to look at a trust-building mechanism for promoting successful blockchain technology

adoption. There are many studies which explore the trust-building process in the technology adoption (Gefen et al. 2003; Kramer 1999; McKnight et al. 2002). For example, McKnight et al. (2002) examine the main factors that influence individuals' trust to adopt the technology. Their study finds reputation and quality, and structural assurance to be important factors that influence individuals' trust and behavioral intention in technology adoption. In this paper, our study is based on their trust-building framework as an overarching theory to develop our theoretical model. To strengthen the theoretical basis of our proposed theoretical model, we have reviewed and summarized relevant literature on the trust-building in technology adoption as shown in Table l.

As shown in Table 1, Lin et al. (2014) and Liu and Tang (2018) believe that technical features of a technology including user friendliness and usefulness are important in building customers' trust in technology adoption. Meanwhile, many consumers often rely on the third-party's reputation in technology adoption (Hawlitschek et al. 2018; Wahab et al. 2015). On the other hand, Marriott and Williams (2018) and Zhang et al. (2019) find that some customers consider personal characteristics as significant factors in technology adoption.

Research focus	Main research findings	References
Technical features	The technical features of the technology including ease of navigation, user friendliness, quality and usefulness are beneficial to build customers' trust	Lin et al. 2014; Liu and Tang 2018; Shao et al. 2019
Public impression	Reputation and word-of-mouth recommendation are positively associated with customers' trust in technology adoption	Fatma et al. 2015; Hawlitschek et al. 2018; Wahab et al. 2015
Personal characteristics	Customers' usage behaviors of the technology are based upon personal characteristics such as age, gender and prior experience	Marriott and Williams 2018; Yao and Zhu, 2019, Zhang et al. 2019
Institutional mechanism	The institutional mechanism including technical protection and product warranties are beneficial to build customers' trust	Lu et al. 2016; Ozpolat et al. 2013; Sarkar et al. 2020; Xin et al. 2015

Table 1. Research focus of trust-building in technology adoption

In the context of blockchain technology adoption, McKnight et al. (2002) point out that institutional mechanisms can enable technologies to overcome adoption barriers. This is supported by Sarkar et al. (2020) who believe that an institutional mechanism plays an important role in building customers' trust towards the technology. It could facilitate the initial trust at the beginning of the adoption process as it is independent of actual interaction between user and technology (Lu et al. 2016). In addition, an effective institutional mechanism can provide assurance to customers that their information is processed and stored in a secure environment.

In this paper, we emphasize on the institutional mechanism of the technology attributes as trust-building mechanisms in our proposed model. In particular, our study focuses on the technical protection, legal protection and vendor guarantee to meet industry criteria. Technical protection ensures the effectiveness and reliability of technology through safeguards and the use of encryption technology (Ozpolat et al. 2013). Meanwhile, legal protection structures allow punishment of inappropriate or opportunistic behaviors, increase predictability and reduce the risk of unwanted outcomes (Kramer 1996). Product warranties as a form of vendor guarantee are provided o customers as a signal for product quality. They allow recourse on the vendor and can thereby positively affect consumers' trust in the product.

2.2 Impact of Quality Practices on Trust

Yao and Zhu (2019) state that good internal processes and effective quality management practices of an organization are very important for delivering quality products or services. This is particularly true when competitiveness is increased, quality is an important source of differentiation from which consumers' loyalty and preferences can be drawn. In the same context, Cronin et al. (2000) confirm that positive opinion of quality contributes to satisfaction and perception of value from customers. In fact, different studies have evidenced the relationship between a consumer's satisfaction of product quality and their loyalty (Cronin et al. 2000; Wahab et al. 2015; Yao and Zhu 2019). However, there is a limited study on the relationship between quality practices and trust in a blockchain technology context. Such trust in the technology and its provider is the main reason where consumers decide on whether or not they should use the technology (Yao and Zhu 2019). Shao et al. (2019) conclude that

more attention and research is needed in this area due to the importance that trust can have in consumers' perception of the technology, and subsequently their adoption intention.

2.3 Diffusion of Innovation Theory

Over the years, scholars have presented various technology adoption models to help organisations adopt new technologies to support their business operations. Some of the technology adoption models include theory of reasoned action, theory of planned behaviour, technology adoption model, social cognitive theory, diffusion of innovation, unified theory of acceptance and use of technology and technology, organization and environment model (Taherdoost 2018). Of these existing models, the diffusion of innovation (DOI) model has become popular because of its ability to predict technology adoption intention using key technology related factors (Xin et al. 2015).

DOI model (Rogers 2003) is well-established in the technology adoption domain for investigating how, why and at what rate technologies are adopted by individuals or organizations. In DOI, characteristics that affect innovation include relative advantage, complexity, compatibility, trialability, and observability (Xin et al. 2015). Among these, relative advantage, complexity and compatibility are more important in predicting user intention to adopt and use a technology (Deng et al. 2019). Along this line, relative advantage, complexity and compatibility are incorporated in the research model for understanding the adoption of blockchain technology. Relative advantage is the degree to which the technology is perceived as being better than the existing idea (Rogers 2003). Blockchain technology has proven to facilitate trusted decentralized transactions across several industries (Zhang et al. 2019). This study considers decentralization as one of the dimensions to measure relative advantage for determining the level of individual's trust in blockchain technology. Transparency is another dimension that can reflect the relative advantage of blockchain technology (Olnes et al. 2017). The proposed model adopts both decentralization and transparency constructs to gain an in-depth understanding of the relative advantage as well as complexity and compatibility towards trust and blockchain technology adoption intention.

3 Research Model and Research Hypotheses

This study develops a conceptual framework by incorporating DOI theory into the trust-building framework to investigate the role of antecedents and the blockchain technology adoption intention behaviour by the sponsors. Based on the importance of key factors presented in the diffusion of innovation model, the proposed framework considers compatibility and complexity factors to study their influence in enabling trust in new technologies and the technology adoption intention. Literature also points out the role of quality practices on building trust. In view of current literature, this study adopted quality practices as a moderator. Figure 1 presents the proposed theoretical model.

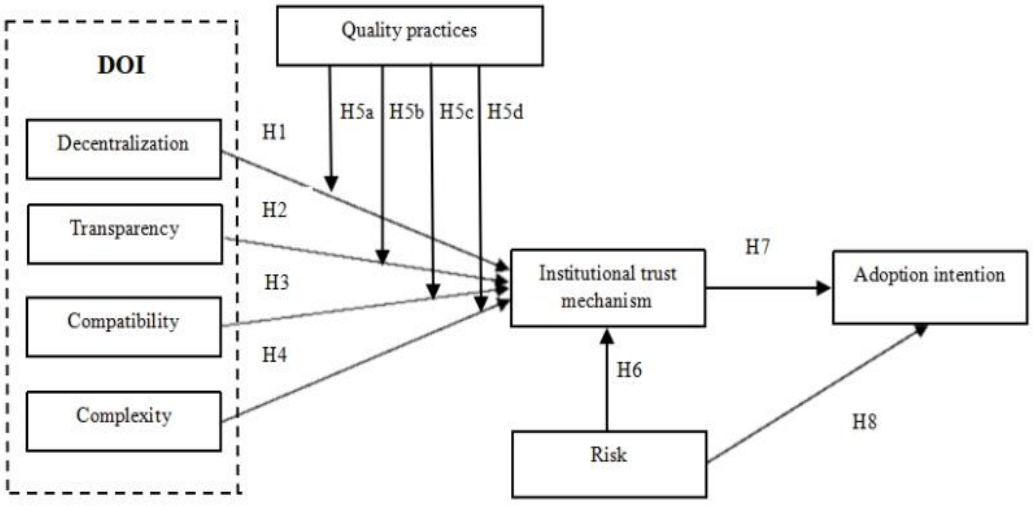

Figure 1. The Research Model

In line with DOI theory, the proposed framework considered the role of decentralization and transparency factors to demonstrate the benefits of blockchain technology. Security, compatibility and complexity of the technology are proven to be the antecedents in the trust-building framework proposed by Lin et al. (2014). Table 2 defines the factors presented in the proposed framework.

3.1 Decentralization

Decentralization is the relative advantage of being able to access and use the blockchain technology at anytime and anywhere. In terms of blockchain technology, the technology presents an opportunity for people to interact with one another and conduct transactions without the need of centralized intermediaries (De Filippi and Loveluck 2016). Olnes et al. (2017) state that both trust and decentralization are closely interrelated in case of blockchain technology. Lin et al. (2014) claim that decentralization facilitates the creation of a private, reliable and versatile environment, which in turn promotes trust in the use of the technology. Thus, decentralization is important to increase customers' trust in blockchain technology. Thus, the following hypothesis is derived:

H1: Decentralization positively influences trust in blockchain technology.

Factor	Definition	References
Decentralization	It is the relative advantage of being able to access the new technology from anywhere and anytime	De Filippi and Loveluck 2016; Lin et al. 2014; Olnes et al. 2017
Transparency	The extent to which information relating to the proposed technology is available to stakeholders	Hawlitschek et al. 2018; Garman et al. 2014; Zhang et al. 2019
Compatibility	The extent to which a new technology is believed to be in line and compatible with the individual's tasks	Choe and Noh 2018; Cronin et al. 2000; Rogers 1995; Sarkar et al. 2020; Shao et al. 2019
Complexity	The extent to which a new technology is believed as complex to learn and use	Rogers 1995; Sarkar et al. 2020; Xin et al. 2015
Quality practices	Organisational practices associated with achieving excellence through the use of technology	Gefen et al. 2003; Shao et al. 2019; Venkatesh and Goyal 2010; Yao and Zhu 2019
Risk	It is the users' perception of potential harm from the proposed technology	De Filippi and Loveluck 2016; Ho et al. 2017; Venkatesh and Goyal 2010; Wibowo and Mubarak 2020
Trust	It is the extent of individuals' belief that the technology will support them in their work	Gefen et al. 2003; Neupane et al. 2019; Xin et al. 2015
Technology adoption intention	The users' willingness to adopt the proposed technology	Choe and Noh 2018; Venkatesh and Goyal 2010

Table 2. Research focus of trust-building in technology adoption

3.2 Transparency

Transparency is the extent to which information is readily available to both counter-parties in exchange and also to outside observers (Hawlitschek et al. 2018). The underlying concept of blockchain technology is to facilitate decentralized secure transactions among the participants. Considering the nature of blockchain technology, trust establishing mechanisms are built based on data immutability, transparency and integrity. These mechanisms are critical for facilitating reliable and dependable transactions through a decentralized network (Garman et al. 2014). Zhang et al. (2019) state that transparency has remarkable interpreting ability on trust in blockchain technology. Hence, this research presents the following hypothesis:

H2: Transparency positively influences trust in blockchain technology.

3.3 Compatibility

Compatibility is a measure of the degree to which an innovation is perceived as being compatible with existing values, past experiences, and the needs of potential adopters (Rogers 1995). If a technology fits with the *consumer's* life-situation and needs, it would be compatible and, therefore, it would be preferred over alternative technologies. Shao et al. (2019) suggest that compatibility may be of relatively lower magnitude in predicting the rate of adoption than relative advantage. On the other hand, other study findings show that compatibility has a significant positive relationship with the

technology adoption. Sarkar et al. (2020) find compatibility to have a positive influence on technology use intentions. In some cases, perceived compatibility has been shown to be the best perception-based indicator of use intentions (Cronin et al. 2000). Therefore, the hypothesis is proposed as follow:

H3: Compatibility positively influences trust in blockchain technology.

3.4 Complexity

Complexity is a measure of the degree to which an innovation is perceived as difficult to understand and use (Rogers 1995). For example, if consumers find it difficult either to locate or to handle these technologies, they *would* be put off from using it for their purchases. Xin et al. (2015) state that ease of use of a technology is an important motivator and a predictor of its rate of adoption. Sarkar et al. (2020) report complexity as a significant predictor of citizens' intention to purchase goods over the web. Along this line, if a technology is relatively easy to use and helpful, it will have a positive influence on an individual's intention towards using that technology. Thus, this hypothesis is derived:

H4: Complexity negatively influences trust in blockchain technology.

3.5 The Moderating Effect of Quality Practices

Wahab et al. (2015) suggest that quality practices must include excellence, value, and meeting and/or exceeding customer requirements. Yao and Zhu (2019) find that improving the quality of a technology helps in reducing the perceived risks of the customers and building their trust in their intentions to use the technology. Earlier studies point out that quality practices have a positive relationship towards trust of the technology (Gefen et al. 2003; Shao et al. 2019). For example, if technology providers attempt to improve service to gain customer trust, the use of technology will increase continuously (Gefen et al. 2003). Marriott and Williams (2018) have found that trust substantially affected perceived risk and usage intentions. De Filippi and Loveluck (2016) state that the concept of decentralization is often viewed as the most important feature of blockchain technology. Garman et al. (2014) point out that the level of quality practices has an influence on the decentralization of the technology. Yao and Zhu (2019) confirm the positive moderating effect of quality practice on transparency. They provide an example whereby high-quality practices and transparency of the technology increase the number of consumers in using the online system. Meanwhile, Marriott and Williams (2018) point out that complexity of the technology influences consumer trust towards the online services offered by the merchants.

The following hypotheses are therefore proposed:

H5a: Quality practices moderate the positive effect of decentralization on trust

H5b: Quality practices moderate the positive effect of transparency on trust

H5c: Quality practices moderate the positive effect of compatibility trust

H5d: Quality practices moderate the negative effect of complexity on trust

3.6 Perceived Risk, Trust and Adoption Intention

Perceived risk is defined as an individual's subjective belief and expectation of potential harm, resulting from a particular situation or a set of circumstances, and thus influence the process of decision-making (Ho et al. 2017; Wibowo and Mubarak 2020). Venkatesh and Goyal (2010) state that perceived risk would negatively affect a user's intention to use products or services.

Sarkar et al. (2020) believe that perceived risk and trust are two important antecedents of customers' behavior in technology adoption intention. Gefen et al. (2003) point out that initial trust plays an important role when the trustor has limited knowledge about the new technology being used for conducting financial transactions electronically. Without this initial trust, the trustor would be unwilling to participate in online financial transactions. Meanwhile, Neupane et al. (2019) point out that when there is minimal risk of security in the technology, there would be more trust towards such technology. Xin et al. (2015) state that consumer perception toward risk has been identified as some of the major problems causing consumers' hesitant toward taking advantage of the online system. The following hypothesis is therefore proposed:

H6: Perceived risk negatively influences trust in blockchain technology.

H7: Trust positively influences the adoption intention of blockchain technology.

H8: Perceived risk negatively influences the adoption intention of blockchain technology.

4 Proposed Methodology and Future Work

The overarching goal of this research-in-progress paper is to examine the trust-building mechanisms in the adoption of blockchain technology. Based on literature review on technology adoption studies, this study operationalizes how trust in technology can influence the technology adoption decision. Accordingly, the research model shown in Figure 1 is presented to empirically test the hypotheses. In line with the positivist approach, a sample of items measuring the individuals' understanding of blockchain technology will be generated. In particular, their opinions about the importance of decentralization, transparency, compatibility, complexity, quality practices and risk on trust will be studied using the items generated earlier. Then, the additional items measuring the influence of trust on blockchain technology adoption decision will be generated.

The survey questionnaire comprises of three parts. The first part includes questions seeking responses on basic demographic characteristics such as participant's age, gender, education level, occupation and experience with online transactions. The second part seeks responses from the participants on their technology and blockchain adoption experiences and general evaluation. The final part requires participants to specify the extent to which they agree or disagree on the developed hypotheses. A sample size of 500 will be collected from IT managers from both private and public service organizations in Australia. A quantitative approach based on an online survey instrument will be used for data collection to test the research model. Construct items will be tested using a 5-point Likert scale ranging from (1) Strongly Disagree to (5) Strongly Agree. A statistical analysis tool IBM SPSS will be used for preliminary tests such as reliability tests and exploratory factor analysis to ensure data validity. This study intends to use the structural equation modelling (SEM) technique for testing the relationships among the constructs presented in the research model.

5 Expected Contribution

The goal of this study is to assess the importance of trust building mechanisms and the impact of various factors in blockchain technology adoption. Findings of this study are expected to have both theoretical and practical implications. From the theoretical side, this study will contribute to the IS body of knowledge on trust determinants and blockchain technology adoption. On the practical side, this study provides insight for public policy makers and organizations to understand key factors affecting blockchain technology adoption, which is necessary for effective planning and implementation of blockchain technology.

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