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# An empirical study on the adoption of blockchain-based games from users' perspectives

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# Abstract

Purpose - The purpose of the research is to investigate users' adoption of blockchain-based games in China.

**Design/methodology/approach** – This research applied existing technology diffusion theories to develop a research model to examine users' adoption of blockchain-based games. As a result, a research model with nine research hypotheses was developed. The developed research model was empirically tested using data collected from a survey of 210 blockchain-based games users. Structural equation modeling was applied to analyse the collected data.

**Findings** – The results indicated that seven of nine research hypotheses were supported. It was found that trust, perceived usefulness, perceived enjoyment and perceived ease of use were key determinants for users' behavioural intention to use blockchain-based games. The most influential relationship in the research model appeared to be the effect of perceived usefulness on users' behavioural intention to use blockchain-based games. However, subjective norms did not have significant positive impacts on users' behavioural intention to use blockchain-based games.

**Practical implications** – The regulatory support from governmental authorities is essential to provide additional legal certainty to build users' trust in playing blockchain-based games. Blockchain-based games providers should arrange the training program targeted to the general users to enhance their understanding of the key features associated with blockchain-based games. Blockchain-based games developers should come up with good design solutions to maximize user enjoyment with blockchain-based games by considering additional entertainment elements.

**Originality/value** – To the best of the authors' knowledge, this study is first of its kind in investigating the adoption of blockchain-based games from users' perspectives. This study contributes to the existing literature on the adoption of blockchain technology.

**Keywords** Technology adoption, TAM, Perceived enjoyment, Trust, Subjective norms, Blockchain technology, Blockchain-based games

Paper type Research paper



# 1. Introduction

Blockchain technology has been considered as one of the most disruptive innovative technologies. Blockchain has gained increasing attention from academia and industry since

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the debut of Bitcoin in 2008. Bitcoin is an entirely digital distribute currency, launched through a white paper by Nakamoto (2008). One of Bitcoin's key innovations is the creation of a decentralized public transaction ledger, called the *blockchain*, which is transparent and immutable, being cryptographically verifiable by all participants in the Bitcoin network (Folkinshteyn and Lennon, 2016). Transactions are denominated in units of its own currency, termed Bitcoin, so the system is not dependent on any particular national currency or geographical location; hence, it is completely digital and international in scope.

The disruptive potential of blockchain technology enabled the possibility to expand the application of this technology into a number of contexts (e.g. supply chain management, healthcare, gaming, digital authentication, asset trading). However, previous studies on the individual adoption behaviour of blockchain technology tended to focus on the context of supply chain management. For instance, Kamble *et al.* (2019) examined the adoption of blockchain technology in supply chain in India. Queiroz and Fosso Wamba (2019) investigated the individual blockchain adoption behaviour in the supply chain field in both India and the USA based on a revised unified theory of acceptance and use of technology (UTAUT) model (Venkatesh *et al.*, 2003). Queiroz *et al.* (2020) studied the driving factors and barriers to the adoption behaviour of blockchain technology in operations and supply chain management in Brazil. Little empirical investigation has been conducted to understand the adoption of blockchain technology on gaming.

Researchers have not systematically assessed the influence of blockchain technology on gaming because it has been only a few years since blockchain technology applied to online games. Before the wide implementation and adoption of blockchain technology in the gaming industry, it is important to have a better understanding of potential factors that would influence the adoption of blockchain-based games from the end users' points of view.

To bridge the research gap, this study aims to provide insights into understanding the adoption of blockchain-based games. This study develops a research model to examine user adoption of blockchain-based games. As a result, a research model with nine research hypotheses was developed. The research model is empirically tested using survey data collected from 210 users of blockchain-based games in China.

This study contributes to the adoption of blockchain technology in two ways. First, this study is one of the first empirical studies focusing on the adoption of blockchain-based games. By building a research model based on previous technology diffusion theories, the perspectives of end users on the adoption of blockchain-based games have been examined. Second, this study contributes to practice by providing some insights for game developers and providers to better promote the use and diffusion of blockchain-based games.

The rest of this paper is organized as follows. Section 2 presents the theoretical background. Then, the research model and hypotheses are presented in Section 3. After that, an empirical study with blockchain-based games users are described in Section 4. Finally, the conclusion and a discussion of the findings of this study are presented in Section 5.

# 2. Theoretical background

### 2.1 Blockchain technology

Blockchain technology refers to a distributed system for cryptographically capturing and storing a consistent, immutable, linear event log of transactions between networked actors using a consensus mechanism (Risius and Spohrer, 2017). The blockchain constitutes a set of protocols and cryptographic methods applied to a network of nodes that collaborate to achieve the secure recording of data within a distributed database that comprises encrypted blocks that encapsulate the data (Macrinici *et al.*, 2018). The blockchain technology

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underlying Bitcoin and other cryptocurrencies allows for a shared digital ledger that is a continually updated list of all transactions (Morisse, 2015).

Bitcoin is the first application of blockchain technology. Bitcoin offered a new, enhanced way of capital circulation, new markets and new decentralised autonomous organisations (Hsieh *et al.*, 2018). Ethereum (Buterin, 2014) is another well-known implementation of blockchain, which is designed to facilitate smart contracts. A smart contract can be used to eliminate the interference of any third party and further enhances the decentralization of a network. Blockchain technology is able to offer a solution to the problem where there is a need for a reliable ledger in a decentralized environment where not all parties, whether humans or machines, can be fully trusted (Tshering and Gao, 2020). Blockchain technology has been successfully applied in application scenarios, such as education (Bdiwi *et al.*, 2017), logistics (Christodoulou *et al.*, 2018), health care (Dagher *et al.*, 2018), energy (Hou *et al.*, 2018), supply chain management (Kshetri, 2018) and games (Min *et al.*, 2019).

## 2.2 Blockchain-based games

Blockchain-based games are online games that use blockchain technology. In other words, these games are online and designed on the basis of blockchain technology. For instance, cryptocurrencies, such as Bitcoin or Ethereum, can be used as one of the ways for conducting financial transactions within online games. Blockchain technology has been regarded as a disruptive innovation in many application areas, such as financial services, supply chain management and governance models (Campbell-Verduyn and Goguen, 2017). Blockchain technology can be applied to financial transactions in online games to ensure the openness and fairness of financial transactions.

A blockchain-based game is able to offer the true ownership of a digital game asset, as the link to the owner of the asset can be written on an immutable blockchain in terms of smart contracts. Smart contracts are open source programs written on the Ethereum blockchain platform. Smart contracts are constantly being calculated as digital game asset transactions are verified by the involved game players. The digital game asset ownership can be tracked via a smart contract on the blockchain. The smart contracts on the blockchain can also be used to enable instant transfer of ownership of a digital game asset securely without involving any third parties. As a result, smart contracts help to enforce digital game asset ownerships and ensure the openness of digital game asset transactions.

Released in 2017, CryptoKitties is one of the most popular games based on blockchain technology, namely, the Ethereum network. Blockchain is capable of building a clear and reliable digital ownership through mining where a user can claim ownership of new tokens contributing with a node. Any transaction data of the blockchain is visible, reliable and accessible to the involved participants of blockchain (Lu, 2019). Users can breed, trade and gift different types of virtual cats with CryptoKitties. The blockchain technology helps to both guarantee the ownerships of virtual cats with CryptoKitties and ensure the validity of various financial transactions on CryptoKitties. The associated financial transactions with CryptoKitties, such as selling or breeding, are enforced by smart contracts. Each cat is unique and cannot be handled by anyone other than its owner. The cat's ownership is tracked and proven by smart contract associated with CryptoKitties.

Gods Unchained is another popular blockchain-based game. It is a turn-based collectible digital card trading game that operates on the Ethereum blockchain. The ownership of each card is guaranteed by a smart contract. Smart contracts enable users to trade and sell their cards freely with the true ownership of the cards. In addition, there are other examples of existing blockchain-based games (e.g. Etheremon, HyperSnakes, HyperDragons).

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### 2.3 Technology diffusion theories

One of the important and long-standing research questions in information systems research is user adoption of information systems (DeLone and McLean, 1992). Several models, such as the technology acceptance model (TAM) (Davis, 1989), UTAUT (Venkatesh *et al.*, 2003), theory of planned behavior (TPB) (Ajzen, 1991) and innovation diffusion theory (Rogers, 1995), have been developed to test user attitude and intention to adopt new technologies.

As listed in Table 1, TAM has been widely used in previous studies on the adoption of blockchain technology. For instance, an extended TAM model has been used to examine the adoption of cryptocurrencies (Shahzad *et al.*, 2018) and smart lockers (Lian *et al.*, 2020). TAM has been expanded to investigate different study objects by taking into consideration the characteristics of the study object in previous studies. For example, research on the adoption of online games indicated that perceived enjoyment and subjective norms have a significant impact on users' behaviour intention to use online games (Lee and Tsai, 2010). Trust has been identified as one predicting factor for the adoption of blockchain technology in supply chain in previous studies (Queiroz *et al.*, 2020). This study aimed to extend TAM with additional factors, such as trust, perceived enjoyment, subjective norms, security and privacy, to examine user adoption of blockchain-based games. The research model and research hypotheses are presented in Section 3.

### 2.4 Adoption of blockchain technology

Compared to the rapid development of blockchain technology, the research on the adoption of this technology is still in its infancy stage. Based on the literature review, some existing research on the adoption of blockchain technology is summarized in Table 1. It appears that

Article	Object studied	Applied theory	Findings	
Folkinshteyn and Lennon (2016)	Bitcoin	ТАМ	It was found that perceived usefulness mainly comes from the feature of openness with Bitcoin, which improves the transaction efficiency. However, at the same time, users are exposed to transaction risks	
Kamble <i>et al.</i> (2019)	Blockchain technology adoption in supply chains	TAM, TRI, TPB	Perceived usefulness, attitude, and perceived behavioural control affect behavioural intention. Subjective norm has a negligible impact on behavioural intention. Discomfort and insecurity in the TRI model do not have a significant impact on the user	
Shahzad <i>et al.</i> (2018)	Cryptocurrencies	TAM	It was found that awareness, perceived ease of use, perceived usefulness, and perceived trustworthiness had significant impacts on the intention to use Bitcoin among people in China	
Queiroz and Fosso Wamba (2019)	Blockchain technology adoption in the logistics and supply chain field	UTAUT	It was found that performance expectancy positively affected the behavioural intention to adopt blockchain in the logistics and supply chain in both India and the US. The influence of facilitating conditions on the adoption of blockchain was the case only in the US	Table 1.
Lian <i>et al.</i> (2020)	Blockchain-based smart lockers	ТАМ	It was found that perceived usefulness and perceived ease of use are the critical factors. It also indicated that safety was not the major concern when using a blockchain-based smart locker	Previous studies on the adoption of blockchain technology

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EL most previous studies on the adoption of blockchain tended to focus on digital currencies (Folkinshteyn and Lennon, 2016; Shahzad *et al.*, 2018) and applications in the field of supply chain (i.e. Kamble *et al.*, 2019; Queiroz and Fosso Wamba, 2019).

Most existing studies on blockchain-based games tended to focus on the value and fairness aspects. For instance, Serada *et al.* (2020) studied the value created through blockchain-based games. They found the following three major factors determining the value of cryptogame tokens: blockchain as a sociotechnical infrastructure, perceived materiality of tokens and pseudo true ownership (Serada *et al.*, 2020). In addition, Sako *et al.* (2021) examined the fairness of markets in blockchain-based games. Furthermore, Li and Gao (2019) explored the values of blockchain-based games from users' perspectives in China. However, the research on the adoption of blockchain-based games from users' perspectives has not yet been explored. This study is an early effort to explore the adoption of blockchain-based games.

# 3. Research model and research hypotheses

According to the findings in Table 1, TAM has been mostly applied in previous studies on the adoption of blockchain technology. Therefore, TAM has been selected as a base model to explore the adoption of blockchain-based games in this study. The proposed research model for studying the adoption of blockchain-based games is presented in Figure 1. The research model is an extended model based on TAM. In addition to perceived ease of use, perceived usefulness and behaviour intention to use from TAM, the model includes trust, perceived security, privacy, perceived enjoyment and subjective norms as factors to study user adoption of blockchain-based games. Nine research hypotheses based on the research model have been proposed in this research model. Each hypothesis as labelled and elaborated in Figure 1.

#### 3.1 Perceived security

Perceived security has different definitions in various contexts. In the context of ecommerce, Kalakota and Whinston (1996) defined *security* as a threat which creates the "circumstance, condition, or event with the potential to cause economic hardship to data or network resources in the form of destruction, disclosure, modification of data, fraud, and abuse". Previous studies (Salisbury *et al.*, 2001) proved that security was crucial when consumers conducted a transaction online. Moreover, perceived security has been proposed as an antecedent of trust together with perceived privacy (Shin, 2010; Yousafzai *et al.*, 2009).



Figure 1. Research model

Security is also one of the significant considerations when users decide to use the new technology and new applications, especially among early adopters. Security issues must be settled before it would become a feasible and viable option to adopt blockchain technology (Angelis and da Silva, 2019). The distributed trust mechanism of blockchain can help users reduce cybersecurity-related risks, which has been found in supply chain management (Kshetri, 2018). Distributed branches of blockchain reduce the likelihood that the system will crash under attack. Additionally, blockchain technology also enables open rules and transparent transactions, which increase the security of game assets. Thus, the following hypothesis has been proposed:

H1. Perceived security has a positive effect on user trust of blockchain-based games.

# 3.2 Privacy

In traditional online trades, consumers often worried about privacy issues (Liu *et al.*, 2005). In today's mobile internet environment, while mobile users increasingly rely on the use of various mobile applications for their daily activities, the processing of personal data through these applications poses significant risks to user privacy. Data has been collected by various applications to facilitate people's daily lives. Arnott *et al.* (2007) found that the privacy features of a website along with shared values were the key antecedents of trust. Using smart contracts helps to conduct a transaction automatically, avoiding manipulation by others (Angelis and da Silva, 2019). An anonymous mechanism can be used to protect user privacy (Cuccuru, 2017). Yue *et al.* (2016) proposed a blockchain-based application to enable a patient to own, control and share their own data easily and securely without violating privacy, which provided a new potential way to improve the intelligence of health-care systems while keeping patient data private. Similarly, when users use blockchain-based games, their identity information and data can also be protected, which would in turn positively affect user trust on blockchain-based games. Thus, the following hypothesis has been proposed:

H2. Privacy has a positive effect on user trust of blockchain-based games.

# 3.3 Trust

Trust has been a topical subject with technology acceptance in previous literature. Gefen *et al.* (2003) integrated trust into the TAM (Davis, 1989) and found that trust had a positive impact on intended use and trust was influenced by perceived ease of use. Moreover, Hoffman *et al.* (1999) found that distrust of security was the main reason for early users not adopting online shopping. In addition, trust has been proven to have a significant impact on users' behaviour intention to play online games (Wu and Liu, 2007).

Playing blockchain-based games involves frequent transaction confirmation processes in terms of invoking smart contracts. Fleischmann and Ivens (2019) found that trust was a key driver in the adoption of blockchain-based applications which spans across both functional (economic and system-related/process-related) and emotional benefit (social and personal) dimensions. Furthermore, Folkinshteyn and Lennon (2016) indicated that trust was essential in the adoption of digital currency because users have distinctive trust patterns in blockchain-based applications where they have no intermediary or control centre. Because of the encryption and anonymity brought by blockchain technology, blockchain-based games inherit these technical characteristics, enabling users to be more trustworthy of the

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*H3.* Trust has a positive effect on users' behaviour intention to use blockchain-based games.

# 602 3.4 Perceived ease of use and perceived usefulness from the technology acceptance model In the classical technology adoption model, both perceived ease of use of the technology and perceived usefulness of the technology used positively affect users' intention to use the technology. Also, the perceived usefulness of the technology is positively affected by perceived ease of use of the technology. In addition, according to Gefen *et al.* (2003), a user's perceived ease of use of online shopping will affect their trust in online shopping. The easier the users grasp the usage of new technology, the easier they will generate trust behaviour of new technology. Blockchain-based games can be seen as the new innovations. It is believed the hypotheses presented above would apply to blockchain-based games as well. Thus, the following hypotheses have been proposed:

- *H4.* Perceived usefulness has a positive effect on users' behaviour intention to use blockchain-based games.
- H5. Perceived ease of use has a positive effect on trust of blockchain-based games.
- *H6.* Perceived ease of use is positively related to perceived usefulness of blockchainbased games.
- *H7.* Perceived ease of use has a positive effect on users' behaviour intention to use blockchain-based games.

#### 3.5 Perceived enjoyment

Hedonic products have the characteristics of providing users with the value of selfsatisfaction. The psychological experience is influenced by the content of products, such as pictures, sounds, layout and so on. By contrast, users of utilitarian products are mostly driven by the purpose of completing a specific task or by the improvement of efficiency. Users mainly use utilitarian products as tools. Hence, there is a fundamental difference between perceived enjoyment and perceived usefulness (Van der Heijden, 2003). When the purpose of the system is utilitarianism, the reliability coefficient of scale of perceived ease of use and perceived usefulness is better than that of hedonism (Hess *et al.*, 2014).

Perceived enjoyment is defined as the extent to which the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use (Van der Heijden, 2003). Users can have fun when they are playing blockchain-based games. Previous studies indicated that perceived enjoyment had a positive impact on user intention to use a technology. For instance, Ha *et al.* (2007) found that perceived enjoyment in a positive way. Moreover, Liu *et al.* (2005) conducted a study to investigate the driving factors of mobile game adoption in China and found that perceived enjoyment is one of the key driving factors of a person's willingness to play mobile games. Furthermore, Alzahrani *et al.* (2017) found that perceived enjoyment is an important driving factor for the actual use of online games among Malaysian undergraduate students. Thus, the following hypothesis has been proposed:

*H8.* Perceived enjoyment has a positive effect on users' behaviour intention to use blockchain-based games.

# 3.6 Subjective norms

Subjective norms are generated by the normative beliefs that the person attributes to what a relevant other expects them to do with respect to adopting a technology as well as their motivation to comply with those beliefs (Karahanna *et al.*, 1999). The previous literature suggested that subjective norms would have a positive impact on the intention to use the technology (Pavlou and Fygenson, 2006). For instance, TAM2 (Venkatesh and Davis, 2000) suggested a positive relationship between subjective norms and intention to use. In addition, Bhattacherjee (2000) found that subjective norms had a positive effect on users' behaviour intention to use e-commerce services. It is expected that there is a positive relationship between subjective norms and intention based games. Therefore, the following hypothesis has been proposed:

*H9.* Subjective norms has a positive effect on users' behaviour intention to use blockchain-based games.

# 4. An empirical study

To investigate user adoption of blockchain-based games in China, the proposed research model and hypotheses were empirically tested using the structural equation modelling (SEM) approach (Bollen, 1998) with subjects in China.

# 4.1 Instrument development

The validated measurement items from previous studies (Davis, 1989; Kim *et al.*, 2008)) were used as the foundation to create the instrument for this study. For instance, the scales on perceived usefulness, perceived ease of use and behaviour intention came from pre-validated TAM measures (Davis, 1989). Privacy was measured by adapting the scales from Kim *et al.* (2008). Perceived security was measured by adapting the scales from Jarvenpaa *et al.* (2000). Perceived enjoyment was measured by adapting the scales from Van der Heijden (2003). Subjective norms were measured by adapting the scales from Pavlou and Fygenson (2006) and Wu and Chen (2005). As a result, 27 measurement items (Appendix) were included in the instrument survey. A five-point Likert scale, with one being the negative end of the scale (strongly disagree) and five being the positive end of the scale (strongly agree), was used to examine participants' responses to the survey items.

#### 4.2 Data collection and sample

The questionnaire consisted of two parts. In the first part, the respondents were asked to fill out their demographic information (i.e. age, gender, educational level). The online survey was developed on Sojump which was the largest Chinese service provider engaged in online questionnaires in March 2019. A survey weblink including all the survey questions was distributed on a major Chinese social networking platform in November 2019 in China. When the participants opened the weblink, they were briefed about the purpose of the survey before being asked to complete the online questionnaire. Each participant received approximately US\$1 as the incentive for participation. The participants had also been

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EL informed that the results would be reported only in aggregate form so that their anonymity would be assured. A total of 328 questionnaires were collected, including 210 valid questionnaires, and the effective questionnaire response rate was 64.02%. Among the participants, 38.93% of the participants were male and 61.07% were female. Concerning the educational level, 90.95% of the respondents were either university students or who had at least earned a bachelor's degree. Thus, the respondents' education level was quite high in general. Table 2 presents the demographic information of the respondents.

#### 4.3 Test of measure

**Table 2.**Demographicinformation of therespondents

Convergence validity and discriminant validity were tested first. In the confirmatory factor analysis, the factor loadings are all above the minimum acceptable value of 0.70, as shown in Table 3.

To test the reliability and validity of each construct in research model, the internal consistency of reliability of each construct was tested with Cronbach's alpha coefficient. Convergent validity was assessed through the average variance extracted (AVE) and composite reliability (CR). Furthermore, Bagozzi and Yi (2012) proposed the following measurement criteria: the CR should exceed 0.7 and the AVE of each construct should exceed 0.5. As shown in Table 3, all constructs are in acceptable ranges. Furthermore, Cronbach's alpha values range from 0.881 to 0.932. All the constructs are above 0.70. Consequently, the scales are deemed acceptable to continue.

As for discriminant validity, the square roots of AVEs by the constructs were more than correlations among variables in Table 4. The rest in Table 4 is the correlation coefficient of the latent variable. The correlation coefficient was greater than the square root of the mean variance extraction value of the corresponding variable, which proved the good discriminate validity.

In this study, the goodness-of-fit of the measurement model was examined by using five widely-used fit indices: the chi-square/degrees of freedom ( $\chi^2$ /d.f.), the normed fit index (NFI), the comparative fit index (CFI), the root mean square error of approximation (RMSEA) and the standardized root mean square residual (SRMR). The fitness measures in Table 5 indicated that all measures were within acceptable ranges.

		No.	(%)
Gender	Male	123	38.93
	Female	87	61.07
Age	Below 25	81	50.00
0	25-30	78	32.55
	31-40	46	10.07
	Over 40	5	7.38
Educational level	Upper secondary school or below	19	9.05
	University students or above	191	90.95
Familiarity with blockchain-based games	Very familiar	94	44.76
	Heard before	91	43.33
	Never heard	25	11.90
Frequency of use	2–3 times per day	34	16.19
	2–3 times per week	55	26.19
	2–3 times per month	44	20.95
	Hardly use	77	36.67

Constr	uct		Scale item	Factor loading	g CR	AVE	Cronba	ch's alpha	Adoption of
Percei	ved security		SE1	0.837	0.916	0.732	0	.916	based games
			SE2	0.902					based games
			SE3	0.842					
			SE4	0.840					
Privac	У		PR1	0.848	0.908	0.712	0	.905	
			PR2	0.878					605
			PR3	0.858					
			PR4	0.788					
Trust			TR1	0.896	0.934	0.824	0	.932	
			TR2	0.948					
			TR3	0.878					
Percei	ved usefulnes	s	PU1	0.889	0.901	0.754	0	.900	
			PU2	0.892					
			PU3	0.822					
Perceiv	ved ease of us	se	PE1	0.773	0.882	0.651	0	.881	
			PE2	0.849					
			PE3	0.819					
			PE4	0.784					
Percei	ved enjoymer	nt	EN1	0.884	0.904	0.758	0	.903	
			EN2	0.876					
			EN3	0.852					
Subjec	tive norms		SN1	0.804	0.903	0.757	0	.901	Table 3.
			SN2	0.885					Item loadings CR
			SN3	0.917					AVE and Crophach's
Behav	iour intention	to use	BI1	0.860	0.922	0.797	0	.921	
			BI2	0.933					alpha for each
			BI3	0.883					construct
	SE	PR	TR	PU	PE	EN	SN	BI	
SF	0.856								
PR	0.269	0844							
TR	0.347	0.281	0.908						
PU	0.302	0.0220	0.249	0.868					
PĒ	0.325	0.32	0.427	0.441	0.807				
EN	0.412	0.291	0.356	0.356	0.410	0.871			Table 4.
SN	0.089	0.0580	0.030	0.074	0.057	0.173	0.870		Discriminant validity
BI	0.263	0.0860	0.401	0.459	0.477	0.483	0.172	0.893	of constructs

Measures	Recommended criteria	Measurement model	Suggested by authors	
Chi-square/d.f. NFI CFI RMSEA SRMR	<3.0 >0.9 >0.9 <0.09 <0.09 <0.08	1.288 0.913 0.979 0.037 0.057	Hayduk (1988) Bagozzi and Yi (1988) Bentler (1992) Bagozzi and Yi (1988) Hu and Bentler (1998)	Table 5.           Fit indices for the measurement model

EL	4.4 Results of hypotheses testing
394	To test the hypotheses proposed above, data were collected and analysed using the SEM
00,1	(Bollen, 1998). AMOS 22.0 was used to test the structural model. The result of the structural
	model is shown in Figure 2.
	The results of hypotheses testing are presented in Table 6. The <i>p</i> -value indicates the
	significant degree of correlation between the two measured variables. According to the
606	results in Table 6, seven (H1, H3, H4, H5, H6, H7 and H8) of the proposed nine hypotheses
000	were supported.

# 5. Discussion and conclusion

#### 5.1 Conclusion

This study aimed to investigate user adoption of blockchain-based games in China. To address this, a research model based on previous technology diffusion theories was developed and empirically tested with 210 participants in China. According to the results, seven of the developed nine hypotheses were supported. It was found that trust, perceived usefulness, perceived enjoyment and perceived ease of use were key determinants for users' behavioural intention to use blockchain-based games. The most influential relationship in the research model appeared to be the effect of perceived usefulness on users' behavioural intention to use blockchain-based games. However, subjective norms did not have significant positive impacts on users' behavioural intention to use blockchain-based games.

#### 5.2 Theoretical contributions

From a theoretical perspective, the major contribution of this research is the proposed research model which is useful in explaining users' behaviour intention to use blockchainbased games. This study is the first of its kind in investigating the adoption of blockchainbased games from users' perspectives. Previous studies tended to focus on the value created through blockchain-based games (Li and Gao, 2019; Serada *et al.*, 2020). However, there is a research gap on the adoption of blockchain-based games from users' perspectives. This research filled this gap by carrying out an empirical study on the adoption of



Hypothesis	Path Coefficient	Results	Adoption of blockchain-
<i>H1</i> : Perceived security will have a positive effect on trust <i>H2</i> : Privacy will have a positive effect on trust <i>H3</i> Trust will have a positive effect on behaviour intention to use	0.245*** 0.104 0.168***	Supported Not supported Supported	Dased games
blockchain-based games H4: Perceived usefulness will have a positive effect on behaviour intention to use blockchain-based games	0.269***	Supported	607
H5: Perceived ease of use will have a positive effect on trust H6: Perceived ease of use will have a positive effect on perceived usefulness	0.438*** 0.613***	Supported Supported	
<i>H7</i> : Perceived ease of use will have a positive effect on behaviour intention to use blockchain-based games	0.248***	Supported	
H8: Perceived enjoyment will have a positive effect on behaviour intention to use blockchain-based games	0.252***	Supported	
<i>H9</i> : Subjective norms will have a positive effect on behaviour intention to use blockchain-based games	0.092	Not supported	Table 6.Results of
<b>Note:</b> **** <i>p</i> < 0.05			hypotheses testing

blockchain-based games from users' perspectives in China. This research extended and enhanced the understanding of the adoption of blockchain-based games. It contributed to current literature on the adoption of blockchain technology.

The results indicated that perceived usefulness was the most significant influential factor to users' behavioural intention to use blockchain-based games. The use of blockchain-based games was helpful to solve potential problems associated with online game assets trading. Compared with traditional online games, blockchain-based games have the advantage of making the process of online game assets trading more transparent. For instance, a decentralized, open and transparent trading market through smart contracts can be established with blockchain-based games. This is consistent with the findings on the adoption of bike sharing systems (Gao *et al.*, 2019) and the adoption of Bitcoin (Shahzad *et al.*, 2018).

Perceived enjoyment was the second most significant influential factor to users' behavioural intention to use to blockchain-based games. A well-designed blockchain-based game would motivate users to play the game. This is in line with the findings from Alzahrani *et al.* (2017). Alzahrani *et al.* (2017) found that perceived enjoyment in the game was one of the major motivations for a user to play the game.

The positive influence of trust on users' behavioural intention to use blockchain-based games has been supported in this study. There are many game assets transactions within blockchain-based games. Trust is one of the important elements involved in these transactions. Unless sufficient trust have been accumulated by blockchain-based games among users, users would not choose to trade within these games. This finding is consistent with the findings on the adoption of mobile payment systems (Srivastava *et al.*, 2010), and the adoption of blockchain in operation and supply chain management (Queiroz *et al.*, 2020).

A user's perceived ease of use can promote the formation of user trust in blockchainbased games. At present, most of the blockchain-based games are built on the basis of Ethereum. An open-source blockchain plugin is required to be installed on the blockchainbased gaming platform to enable players to trade assets with their wallets in games. This would give users the ability to link their blockchain wallets to their servers. To trade assets on the blockchain-based gaming platform, users need to install the plugin on the platform. The results from this study indicated that, if the installation process of the plugin on the platform is easy, it would have a significant positive impact on users' behavioural intention to use the games on the platform. Furthermore, it was also found that perceived ease of use had a positive impact on user trust of blockchain-based games. In other words, the improvement on the perceived ease of use of the blockchain-based game by users would be helpful to increase players' trust in the game.

Subjective norms did not have a significant positive influence on users' behavioural intention to use blockchain-based games. This finding is consistent with the finding on the adoption of blockchain technology in supply chains (Kamble *et al.*, 2019). Some users indicated that they often heard of the concept of blockchain. However, they did not have a good understanding of the principles behind applications of blockchain technology. Although blockchain technology is booming in China, some users might misunderstand the concept of blockchain technology. Several major newspapers in China have promoted the development of the blockchain industry by introducing and describing the concept of blockchain, as well as describing innovative blockchain-based applications. However, these newspapers also pointed out users' improper behaviour with blockchain-based applications and recommended that the use of blockchain-based applications should be regulated. Therefore, this would have a negative impact on users' willingness to use blockchain-based applications (e.g. blockchain-based games) from the perspective of subjective norms.

Perceived security had a significant positive impact on user trust of blockchain-based games. Blockchain has inherent characteristics that provide the means for security. For instance, advanced cryptographic techniques are used to secure transactions on blockchain. Kshetri (2017) indicated that the use of blockchain-based systems is secure and can avoid attacks common in present security mechanisms due to the fact that the systems do not have a single point of failure. A secured blockchain-based gaming platform is of help to build user trust in playing games on the platform.

However, privacy did not have a significant positive effect on user trust of blockchain-based games. Some users did have some concerns with the privacy of data transactions on blockchain-based applications. As the transaction data is disclosed on the blockchain and can be viewed by other users, the privacy of the transaction party cannot be guaranteed. One of the appealing aspects of blockchain technology is the degree of transparency that it can provide. In other words, it means transactions within the blockchain wallets owned by one user might be searchable through public transaction records. It implies that it is possible to reveal transaction parties' private transactions on blockchain-based applications. Moreover, it could also be due to users' knowledge on privacy protection mechanisms of blockchain-based applications. For instance, some users might not be aware of or may lack the knowledge of privacy protection mechanisms of blockchain-based games). Previous studies (Krombholz *et al.*, 2016) also revealed that the majority of users were not aware of backup mechanisms and the inbuilt privacy designs of blockchains.

#### 5.3 Practical implications

This study also provides some practical implications. It is of help for practitioners to gain a better understanding of the factors surrounding the adoption of blockchain-based games.

First, trust was found to have a significant positive impact on user intention to use blockchainbased games. The significant effect of trust on user intention to use blockchain-based games should be a focus of attention for developers and providers of blockchain-based games. A good understanding of security protection mechanisms of blockchain technology is essential to build user trust on blockchain-based games. Therefore, it is important for the providers of blockchain-based

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games to dedicate their time and efforts in enhancing users' knowledge on various security issues with blockchain technology. For instance, providers of blockchain-based games can offer some interesting video clips to introduce key security protection mechanisms of blockchain technology in an easy-to-understand manner. Moreover, developers of blockchain-based games should also improve their understanding of trust-related concerns from users' perspectives to better fulfil user expectations with playing blockchain-based games. Furthermore, regulatory support from governmental authorities would provide additional legal certainty to build user trust in playing blockchain-based games. For instance, the government can issue regulatory guidance to regulate various issues with financial transactions associated with blockchain-based games.

Second, perceived ease of use was another predictor for maximizing the adoption of blockchainbased games. Some users might face problems with installing relevant plugins on the gaming platform to play blockchain-based games due to the lack of required knowledge. Developers of blockchain-based games should design a good solution to ease users' efforts with plugin installation for playing blockchain-based games. Furthermore, some users might lack knowledge of blockchain technology when playing blockchain-based games. Providers of blockchain-based games should arrange the training program targeted to the general users to enhance their understanding of key features associated with blockchain-based games.

In addition, the findings indicated that perceived enjoyment did have a positive impact on users' behavioural intention to use blockchain-based games. The users of blockchainbased games would like to have an enjoyable and fun experience when playing blockchainbased games. Developers of blockchain-based games should create good design solutions to maximize users' enjoyment with blockchain-based games by considering additional entertainment elements.

#### 5.4 Limitations

There were some limitations with this study. First, the research model and hypotheses were only tested in one country (i.e. China). Therefore, the generalizability of the results to other countries remains to be determined. Second, the findings of this study may be limited due to the relatively small sample size. This sample may not be fully representative of the entire population in China. Third, all the data were collected using self-reported scales in this study. This may lead to some cautions because common method variance may account for some of the results. Fourth, it was found that *H2* and *H9* were not supported in this study. Thus, this needs to be further investigated in additional studies. Last but not least, there might exist other factors that influence user adoption of blockchain-based games.

#### 5.5 Future research recommendations

There exist some recommendations for future research. First, this study found some potential barriers for the adoption of blockchain-based games. For instance, some users had problems with playing blockchain-based games due to a lack of knowledge of blockchain technology. Some users did not have a good understanding of security issues based on blockchain technology. Future studies can look further into these barriers by interviewing users of blockchain-based games. This would provide additional opportunities to further understand the adoption of blockchain-based games from users' perspectives. Second, as the development of blockchain-based games is yet in an early stage, there will be more and more blockchain-based games with these new blockchain-based games. Third, generalizability of the findings in this study can be further explored by expanding the subjects of this study to other countries. Furthermore, some mediating factors (e.g. gender) may provide new opportunities for future research.

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- Ajzen, I. (1991), "The theory of planned behavior", Organizational Behavior and Human Decision Processes, Vol. 50 No. 2, pp. 179-211.
  - Alzahrani, A.I., Mahmud, I., Ramayah, T., Alfarraj, O. and Alalwan, N. (2017), "Extending the theory of planned behavior (TPB) to explain online game playing among Malaysian undergraduate students", *Telematics and Informatics*, Vol. 34 No. 4, pp. 239-251.
  - Angelis, J. and da Silva, E.R. (2019), "Blockchain adoption: a value driver perspective", Business Horizons, Vol. 62 No. 3, pp. 307-314.
  - Arnott, D.C., Wilson, D., Mukherjee, A. and Nath, P. (2007), "Role of electronic trust in online retailing", European Journal of Marketing, Vol. 41 Nos 9/10, pp. 1173-1202.
  - Bagozzi, R.P. and Yi, Y. (1988), "On the evaluation of structural equation models", *Journal of the Academy of Marketing Science*, Vol. 16 No. 1, pp. 74-94.
  - Bagozzi, R.P. and Yi, Y. (2012), "Specification, evaluation, and interpretation of structural equation models", *Journal of the Academy of Marketing Science*, Vol. 40 No. 1, pp. 8-34.
  - Bdiwi, R., De Runz, C., Faiz, S. and Cherif, A.A. (2017), "Towards a new ubiquitous learning environment based on blockchain technology", *IEEE 17th International Conference on Advanced Learning Technologies (ICALT'17)*, pp. 101-102.
  - Bentler, P.M. (1992), "On the fit of models to covariances and methodology to the bulletin", *Psychological Bulletin*, Vol. 112 No. 3, p. 400.
  - Bhattacherjee, A. (2000), "Acceptance of e-commerce services: the case of electronic brokerages", IEEE Transactions on Systems, Man, and Cybernetics – Part A: Systems and Humans, Vol. 30 No. 4, pp. 411-420.
  - Bollen, K.A. (1998), Structural Equation Models, Wiley Online Library.
  - Buterin, V. (2014), "A next-generation smart contract and decentralized application platform", *Ethereum White Paper*, Vol. 3 No. 37.
  - Campbell-Verduyn, M. and Goguen, M. (2017), "The mutual constitution of technology and global governance: bitcoin, blockchains, and the international anti-money-laundering regime", in Campbell-Verduyn, M. (Ed.), *Bitcoin and beyond: Cryptocurrencies, Blockchains and Global Governance*, Routledge, New York, NY, pp. 69-87.
  - Christodoulou, P., Christodoulou, K. and Andreou, A. (2018), "A decentralized application for logistics: using blockchain in real-world applications", *The Cyprus Review*, Vol. 30 No. 2, pp. 171-183.
  - Cuccuru, P. (2017), "Beyond bitcoin: an early overview on smart contracts", International Journal of Law and Information Technology, Vol. 25 No. 3, pp. 179-195.
  - Dagher, G.G., Mohler, J., Milojkovic, M. and Marella, P.B. (2018), "Ancile: privacy-preserving framework for access control and interoperability of electronic health records using blockchain technology", *Sustainable Cities and Society*, Vol. 39, pp. 283-297.
  - Davis, F.D. (1989), "Perceived usefulness, perceived ease of use and user acceptance of information technology", MIS Quarterly, Vol. 13 No. 3, pp. 319-340.
  - DeLone, W. and McLean, E. (1992), "Information systems success: the quest for the dependent variable", *Information Systems Research*, Vol. 3 No. 1, pp. 60-95.
  - Fleischmann, M. and Ivens, B. (2019), "Exploring the role of trust in blockchain adoption: an inductive approach", Proceedings of the 52nd HI International Conference on System Sciences.
  - Folkinshteyn, D. and Lennon, M. (2016), "Braving bitcoin: a technology acceptance model (TAM) analysis", *Journal of Information Technology Case and Application Research*, Vol. 18 No. 4, pp. 220-249.
  - Gao, S., Li, Y. and Guo, H. (2019), "Understanding the adoption of bike sharing systems: by combining technology diffusion theories and perceived risk", *Journal of Hospitality and Tourism Technology*, Vol. 10 No. 3, pp. 464-478.

- Gefen, D., Karahanna, E. and Straub, D.W. (2003), "Trust and TAM in online shopping: an integrated model", *MIS Quarterly*, Vol. 27 No. 1, pp. 51-90.
- Ha, I., Yoon, Y. and Choi, M. (2007), "Determinants of adoption of mobile games under mobile broadband wireless access environment", *Information and Management*, Vol. 44 No. 3, pp. 276-286.
- Hayduk, L.A. (1988), Structural Equation Modeling with LISREL: Essentials and Advances, JHU Press.
- Hess, T.J., McNab, A.L. and Basoglu, K.A. (2014), "Reliability generalization of perceived ease of use, perceived usefulness, and behavioral intentions", *MIS Quarterly*, Vol. 38 No. 1, pp. 1-28.
- Hoffman, D.L., Novak, T.P. and Peralta, M. (1999), "Building consumer trust online", *Communications of the ACM*, Vol. 42 No. 4, pp. 80-85.
- Hou, J., Wang, H. and Liu, P. (2018), "Applying the blockchain technology to promote the development of distributed photovoltaic in China", *International Journal of Energy Research*, Vol. 42 No. 6, pp. 2050-2069.
- Hsieh, Y.Y., Vergne, J.P., Anderson, P., Lakhani, K. and Reitzig, M. (2018), "Bitcoin and the rise of decentralized autonomous organizations", *Journal of Organization Design*, Vol. 7 No. 1, p. 1-16.
- Hu, L-T. and Bentler, P.M. (1998), "Fit indices in covariance structure modeling: sensitivity to underparameterized model misspecification", *Psychological Methods*, Vol. 3 No. 4, pp. 424.
- Jarvenpaa, S.L., Tractinsky, N. and Vitale, M. (2000), "Consumer trust in an internet store", Information Technology and Management, Vol. 1 Nos 1/2, pp. 45-71.
- Kalakota, R. and Whinston, A.B. (1996), *Frontiers of Electronic Commerce*, Addison Wesley Longman Publishing.
- Kamble, S., Gunasekaran, A. and Arha, H. (2019), "Understanding the blockchain technology adoption in supply chains-Indian context", *International Journal of Production Research*, Vol. 57 No. 7, pp. 2009-2033.
- Karahanna, E., Straub, D.W. and Chervany, N.L. (1999), "Information technology adoption across time: a cross-sectional comparison of pre-adoption and post-adoption beliefs", *MIS Quarterly*, Vol. 23 No. 2, pp. 183-213.
- Kim, D.J., Ferrin, D.L. and Rao, H.R. (2008), "A trust-based consumer decision-making model in electronic commerce: the role of trust, perceived risk, and their antecedents", *Decision Support Systems*, Vol. 44 No. 2, pp. 544-564.
- Krombholz, K., Judmayer, A., Gusenbauer, M. and Weippl, E. (2016), "The other side of the coin: user experiences with bitcoin security and privacy", *International Conference on Financial Cryptography and Data Security*, pp. 555-580.
- Kshetri, N. (2017), "Blockchain's roles in strengthening cybersecurity and protecting privacy", *Telecommunications Policy*, Vol. 41 No. 10, pp. 1027-1038.
- Kshetri, N. (2018), "Blockchain's roles in meeting key supply chain management objectives", International Journal of Information Management, Vol. 39, pp. 80-89.
- Lee, M.-C. and Tsai, T.-R. (2010), "What drives people to continue to play online games? An extension of technology model and theory of planned behavior", *International Journal of Human-Computer Interaction*, Vol. 26 No. 6, pp. 601-620.
- Li, Y. and Gao, S. (2019), "Understanding the values of blockchain based games from users' perspectives: a value-focused thinking approach", 18th Wuhan International Conference on E-Business (WHICEB'19), 24-26 May, Wuhan.
- Lian, J.-W., Chen, C.-T., Shen, L.-F. and Chen, H.-M. (2020), "Understanding user acceptance of blockchain-based smart locker", *The Electronic Library*, Vol. 38 No. 2, pp. 353-366.
- Liu, C., Marchewka, J.T., Lu, J. and Yu, C.-S. (2005), "Beyond concern: a privacy-trust-behavioral intention model of electronic commerce", *Information and Management*, Vol. 42 No. 2, pp. 289-304.

blockchainbased games

Adoption of

EL 39/	Lu, Y. (2019), "The blockchain: state-of-the-art and research challenges", <i>Journal of Industrial</i> <i>Information Integration</i> , Vol. 15, pp. 80-90.
00,4	Macrinici, D., Cartofeanu, C. and Gao, S. (2018), "Smart contract applications within blockchain technology: a systematic mapping study", <i>Telematics and Informatics</i> , Vol. 35 No. 8, pp. 2337-2354.
	Min, T., Wang, H., Guo, Y. and Cai, W. (2019), "Blockchain games: a survey", <i>IEEE Conference on Games (CoG '19)</i> , pp. 1-8.
612	Morisse, M. (2015), "Cryptocurrencies and bitcoin: charting the research landscape", Americas Conference on Information Systems (AMCIS '15).
	Nakamoto, S. (2008), Bitcoin: A Peer-to-Peer Electronic Cash System, Bitcoin White Paper.
	Pavlou, P.A. and Fygenson, M. (2006), "Understanding and predicting electronic commerce adoption: an extension of the theory of planned behavior", <i>MIS Quarterly</i> , Vol. 30 No. 1, pp. 115-143.
	Queiroz, M.M. and Fosso Wamba, S. (2019), "Blockchain adoption challenges in supply chain: an empirical investigation of the main drivers in India and the USA", <i>International Journal of</i> <i>Information Management</i> , Vol. 46, pp. 70-82.
	Queiroz, M.M., Fosso Wamba, S., De Bourmont, M. and Telles, R. (2020), "Blockchain adoption in operations and supply chain management: empirical evidence from an emerging economy", <i>International Journal of Production Research</i> , Vol. 58, pp. 1-17.
	Risius, M. and Spohrer, K. (2017), "A blockchain research framework", <i>Business and Information Systems Engineering</i> , Vol. 59 No. 6, pp. 385-409.
	Rogers, E.M. (1995), The Diffusion of Innovations, Free Press, New York, NY.
	Sako, K. Matsuo, S.I. and Meier, S. (2021), "Fairness in ERC token markets: a case study of CryptoKitties", arXiv preprint arXiv:2102.03721.
	Salisbury, W.D., Pearson, R.A., Pearson, A.W. and Miller, D.W. (2001), "Perceived security and world wide web purchase intention", <i>Industrial Management and Data Systems</i> , Vol. 101 No. 4, pp. 165-177.
	Serada, A., Sihvonen, T. and Harviainen, J.T. (2020), "CryptoKitties and the new ludic economy: how blockchain introduces value, ownership, and scarcity in digital gaming", <i>Games and Culture</i> , doi: 10.1177/1555412019898305.
	Shahzad, F., Xiu, G., Wang, J. and Shahbaz, M. (2018), "An empirical investigation on the adoption of cryptocurrencies among the people of mainland China", <i>Technology in Society</i> , Vol. 55, pp. 33-40.
	Shin, DH. (2010), "The effects of trust, security and privacy in social networking: a security-based approach to understand the pattern of adoption", <i>Interacting with Computers</i> , Vol. 22 No. 5, pp. 428-438.
	Srivastava, S.C., Chandra, S. and Theng, YL. (2010), "Evaluating the role of trust in consumer adoption of mobile payment systems: an empirical analysis", <i>Communications of the Association for Information Systems</i> , Vol. 27, pp. 561-588.
	Tshering, G. and Gao, S. (2020), "Understanding security in the government's use of blockchain technology with value focused thinking approach", <i>Journal of Enterprise Information Management</i> , Vol. 33 No. 3, pp. 519-540.
	Van der Heijden, H. (2003), "Factors influencing the usage of websites: the case of a generic portal in The Netherlands", <i>Information and Management</i> , Vol. 40 No. 6, pp. 541-549.
	Vatanasombut, B., Igbaria, M., Stylianou, A.C. and Rodgers, W. (2008), "Information systems continuance intention of web-based applications customers: the case of online banking", <i>Information and Management</i> , Vol. 45 No. 7, pp. 419-428.
	Venkatesh, V. and Davis, F.D. (2000), "A theoretical extension of the technology acceptance model: four longitudinal field studies", <i>Management Science</i> , Vol. 46 No. 2, pp. 186-204.
	Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003), "User acceptance of information technology: toward a unified view", <i>MIS Quarterly</i> , Vol. 27 No. 3, pp. 425-478.

Wu, IL. and Chen, JL. (2005), "An extension of trust and TAM model with TPB in the initial adoption of on-line tax: an empirical study", <i>International Journal of Human-Computer Studies</i> , Vol. 62 No. 6, pp. 784-808.	Adoption of blockchain-
Wu, J. and Liu, D. (2007), "The effects of trust and enjoyment on intention to play online games", <i>Journal</i> of Electronic Commerce Research, Vol. 8 No. 2, pp. 128-140.	based games
Yousafzai, S., Pallister, J. and Foxall, G. (2009), "Multi-dimensional role of trust in internet banking adoption", <i>The Service Industries Journal</i> , Vol. 29 No. 5, pp. 591-605.	619
Yue, X., Wang, H., Jin, D., Li, M. and Jiang, W. (2016), "Healthcare data gateways: found healthcare intelligence on blockchain with novel privacy risk control", <i>Journal of Medical Systems</i> , Vol. 40 No. 10, pp. 218-225.	613

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# Appendix

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App

	Constructs	Items	Sources
614	Perceived security	<ul> <li>SE1. I feel safe playing blockchain-based games</li> <li>SE2. I believe that blockchain-based games offer a secure way through which to play games</li> <li>SE3. I feel secure managing my game assets with blockchain-based games</li> <li>SE4. I believe that blockchain-based games implement security measures</li> </ul>	Kim <i>et al.</i> (2008) Vatanasombut <i>et al.</i> (2008)
	Privacy	to protect players PR1. I am concerned that blockchain-based games are collecting too much personal information from players PR2. Blockchain-based games will use my personal information for other purposes without my authorization. PR3. Unauthorized persons (i.e., hackers) have access to my personal information when I am playing blockchain based games	Kim <i>et al.</i> (2008)
	Perceived usefulness	PR4. I am concerned about the privacy of my personal information when I am playing blockchain-based games PU1. Playing blockchain-based games would enable me to accomplish my goal of playing games quickly	Davis (1989)
	Perceived ease of use	PU3. Playing blockchain-based games would increase my life quality PU3. Playing blockchain-based games would increase my life quality PE1. Learning to play blockchain-based games is easy for me PE2. It is easy for me to become skilful at playing blockchain-based games.	Davis (1989)
	Trust	PE4. I would find blockchain-based games easy to use TR1. Blockchain-based games are trustworthy TR2. Blockchain-based games well keep game rules	Jarvenpaa <i>et al.</i> (2000)
	Perceived enjoyment	TR3. Blockchain-based games' behaviour meets my expectations EN1. I find blockchain-based games entertaining EN2. I play blockchain-based games for pleasure. EN3. Playing blockchain-based games is an agreeable way of passing time	Van der Heijden (2003)
	Subjective norms	SN1. People who are important to me would think that I should play blockchain-based games SN2. People who influence me would think that I should play blockchain- based games SN3. People whose opinions are valued to me would prefer that I should play blockchain- based games	Wu and Chen (2005) Pavlou and Fygenson (2006)
Table A1. Measurement items	Behaviour intention to use	BI1. Given that I have access to blockchain-based games, I predict that I ewould play them BI2. I am likely to play blockchain-based games in the near future BI3. I am willing to play blockchain-based games in the near future	Davis (1989), Venkatesh and Davis (2000)

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