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THE BLOCKCHAIN TECHNOLOGIES: DO WE REALLY KNOW WHAT WE ARE TALKING ABOUT?

BLOK ZİNCİRİ TEKNOLOJİLERİ: NE HAKKINDA KONUŞTUĞUMUZU GERÇEKTEN BİLİYOR MUYUZ?

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Abstract

The purpose of this study is to give insights into individuals' perceptions of blockchain technologies (BCT). A model is constructed to explore drivers of BCT use and tested empirically using structural equation modeling (SEM) to survey data. Data is collected from a sample of 300 working individuals with engineering and business backgrounds and a multi-item questionnaire is used. Results indicated that reputation affects attitude towards BCT through perceived usefulness and perceived risk and intention to do transactions via BCT can be explained by attitude towards BCT. Intention to use BCT was quite high among the respondents and interestingly their educational backgrounds did not have any effect.

Keywords: Blockchain technologies (BCT), Perceived usefulness, Perceived risk, Reputation, Attitude towards BCT

JEL Classification: M15, O32, O33, O88

Öz

Bu çalışmanın amacı, bireylerin blok zincir teknolojilerine (BZT) ilişkin algılarını incelemektir. BZT kullanımını etkileyen unsurları keşfetmek için oluşturulan teorik model yapısal eşitlik modellemesi (YEM) kullanılarak ampirik olarak test edilmiştir. Araştırmada veriler, mühendislik ve işletme eğitimi geçmişine sahip 300 çalışandan oluşan bir örneklemden toplanmış ve çok maddeli bir anket kullanılmıştır. Sonuçlar, itibarın algılanan fayda ve algılanan risk üzerinden BZT'ye karşı tutumu etkilediğini ve BZT'ye karşı tutumun BZT aracılığıyla işlem yapma niyeti ile açıkladığını göstermektedir. Katılımcılar arasında BZT'yi

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kullanma niyeti oldukça yüksek bulunmuştur ve ilginç bir şekilde sonuçlar eğitim geçmişlerinin istatistiksel olarak anlamlı bir etkisi olmadığını ortaya koymaktadır
Anahtar Kelimeler: Blokzincir teknolojileri (BZT), Algılanan fayda, Algılanan risk, İtibar, BZT'ye karşı tutum
JEL Sınıflaması: M15, O32, O33, O88

1. Introduction

The 21st century turned the world into a huge location for shooting Sci-Fi! Trend topics that keep the agenda busy are Industry 4.0, disruptive technologies, AI, IoT, blockchain, big data, cloud computing, etc. Moreover, on top of all, the COVID-19 Pandemic and lockdowns, curfews triggering distance work-life, distance education, distance social life, etc. Some people are drifting with the hype of these new technologies, whereas others perceive only the dark side and focus on conspiracy theories and robots taking over the world.

One of the technologies, which attracts the business world, is blockchain. Deloitte blockchain survey revealed a strong investment in new blockchain initiatives (Deloitte, 2019). PwC survey of 600 executives from 15 territories showed that 84% of respondents were actively involved with blockchain (PwC, 2018). Gartner forecasted that blockchain would generate an annual business value of more than $176 billion by 2025, and then it would exceed $3.1 trillion by 2030 and 10% to 20% of global economic infrastructure would be running on blockchain-based systems by that year (Gartner, 2017). PwC predicts that blockchain technology could enhance around 40 million jobs globally by 2030 (PwC, 2020).

These reports indicate how important to accept and implement blockchain for the business world in the near future. However, users' resistance to "new" can cause big difficulties, as many examples can be found in change literature. Therefore this study focuses on the employee rather than the business side and aims to measure individuals' willingness to use new technologies namely blockchain technologies (BCT). Hence, intention to transact with BCT and factors affecting it are analyzed using structural equation modeling (SEM) to survey data. The rest of the paper is organized as follows. First, a summary of blockchain technologies will be presented, and then the research model will be introduced. Later, the methodology and findings of the survey will be discussed, and finally the paper will be concluded.

2. Literature Review

2.1. Blockchain technologies

When blockchain technologies are mentioned, many people think about Bitcoin. It is true in the sense that BCT is the underlying technology for Bitcoin (Hughes et al., 2019; Upadhyay, 2020). However, BCT is not limited to cryptocurrencies and financial applications.

A blockchain is a distributed database, where transactions or digital events are stored and shared among participating parties through digital blocks (Crosby et al, 2016; Kimani et al, 2020). Each transaction is verified by the consensus of a majority of the participants in the system, which makes the system immutable (Crosby et al, 2016; Grover, Kar & Ilavarasan, 2018). The digital blocks are arranged together through hashing mechanism to form a chain, where the name blockchain comes from (Kimani et al, 2020; Zheng et al. 2017).

BCT provides a decentralized public ledger, meaning all committed transactions are stored across the network, where cryptography and distributed consensus algorithms provide security and ledger consistency (Crosby et al, 2016; Hooper & Holtbrügge 2021; Zheng et al. 2017). Another important characteristic of BCT is anonymity (Upadhyay, 2020). BCT cuts out the intermediaries and changes traditional businesses given that costs are decreasing, processes are streamlining, speed, and reach are increasing and trust is growing (Hooper & Holtbrügge 2021; Zheng et al. 2017).

Nevertheless, there are also many challenges of BCT. Scalability, security, and legal issues stand out. Scalability is due to the growing size of transactions and the number of entities involved. Hence, process becomes complex and performance slows down. BCT can be vulnerable to various cyber-attacks, privacy leakages; and miners' taking control of computing power to modify the transactions (Al-Jaroodi & Mohamed, 2019; Grover, Kar & Ilavarasan, 2018; Upadhyay, 2020). The unsettled regulatory environment in technology and technical disputes causes costly processes for all parties involved when a problem or legal issue occurs (Grover, Kar & Ilavarasan, 2018).

These are followed by challenges like moving existing contracts, documents to blockchain-based platforms. Behavioral issues like getting consumers used to doing transactions in a digital environment where there are no trusted third parties. There are also challenges like lack of clarity, sufficient knowledge, and skilled human resources (Crosby et al, 2016; Hughes et al, 2019; Upadhyay, 2020).

However, the advantages of BCT outweigh the issues and challenges. So far, BCT is used in financial services mainly, but applications are increasing in a vast area of industries as in healthcare, supply chain, manufacturing, energy, government, entertainment, agriculture and food, robotics, and the internet of things (Al-Jaroodi & Mohamed, 2019; Kimani et al, 2020; Upadhyay, 2020).

2.2. Research model

The potential applications of BCT seem limitless and both the scientific community and the business world are interested in. However, the current research lacks an overview of what the blockchain implies for external and internal consumers. Therefore, this study aims to measure individuals' willingness to use and transact with new BCT.

Acceptance of new technologies has been widely explained by the Technology Acceptance Model (TAM) developed by Davis in 1989. According to empirical results of TAM, perceived usefulness

and perceived ease of use of the potential adopters will affect their attitudes toward using the new technology positively, which trigger the behavioral intentions to use certain technologies. To measure the individuals' willingness to use BCT Technology Acceptance Model is adapted. Yet, applying BCT can be very complicated and since we did not address experts but individuals, we excluded the ease of use dimension from the model. Therefore, we hypothesized

> *H_1: Higher perceived usefulness associated with BCT will cause more positive attitude towards BCT.*
>
> *H_2: Higher positive attitude towards BCT will increase intention to do transaction via BCT.*

In literature, there are extended TAM versions as well, where other constructs are added to the original model. One of the important constructs that affects individuals' willingness to use is perceived risk.

Perceived risk is defined as a consumer's belief about uncertainty related to the potential outcomes of a transaction (Kim, Ferrin & Rao 2008). Uncertainty affects people's confidence in their decisions. The impact of perceived risk on intention to use the technology is related to the conception of perceived behavioral control in the Theory of Planned Behavior (TPB) (Ajzen, 1985; Javernpaa, Tractinsky & Vitale, 2000). The TPB (Ajzen 1991) predicts that consumers would be willing to transact if their risk perceptions were low. If the technology fails and the expected outcome does not occur, individuals intention to transact with this technology will be negatively affected (Im, Kim & Han, 2008). As such, the following hypothesis has been suggested.

> *H_3: Higher perceived risk associated with BCT will cause more negative attitude towards BCT.*

As stated before, too many things are being argued about BCT, especially on media. These discussions are expected to have an impact on individuals. But how? Reputation by definition is a widespread opinion or belief that something has a particular characteristic and is a valuable asset which contributes to the development of long-term relationships (Boyd et al.,2010). Reputation was used as a moderator to trust and the other constructs of the TAM and positive reputation has been viewed as a key factor for diminishing risk and creating trust, consequently affecting the use of technology (Javernpaa et al., 2000; Kim et al., 2008; Pavlou, 2003). With the expectation that the reputation of BCT on employees will affect their intention to be involved with it, we included reputation in our research and hypothesized

> *H_4: Higher perceived positive reputation of BCT will increase perceived usefulness associated with BCT.*
>
> *H_5: Higher perceived positive reputation of BCT will decrease perceived risk associated with BCT.*

H_6: Higher perceived positive reputation of BCT will cause more positive attitude towards BCT.

3. Methodology

3.1. Measures and research instrument

A multi-item questionnaire was used in this study. Intention to transact via blockchain technologies was measured by three items adapted from Jaoude and Saade (2017). To measure perceived usefulness Davis' six-item scale was used (1989). Perceived risk was measured by five items and reputation was measured by three items (Jaoude & Saade 2017). Attitude toward blockchain technologies was measured by three items (Mathieson, Peacock & Chin 2001).

All instruments were measured on a five-point interval scale (1=strongly disagree to 5=strongly agree). Apart from these multi-item questions, demographic variables gender, age and industry type, and questions on whether the respondents were actually using blockchain technologies or not were also asked.

3.2. Sampling and data collection

Data was collected through anonymous self-report questionnaires from a sample of 300 working people of which 150 of them had engineering backgrounds and 150 of them had business backgrounds.

The sample consisted of 112 females (37.3%) and 188 males (62.7%). The mean age of the sample was 34.3 with a standard deviation of 10.4. The profiles of the respondents can be found in Table 1.

Table 1: Profile of respondents

		Respondents' Educational Background			
		Business Administration		Engineering	
Demographic variables		**Frequency**	**Percent (%)**	**Frequency**	**Percent (%)**
Gender	Female	65	43.30	47	31.30
	Male	85	56.70	103	68.70
	Total	150	100.00	150	100.00
Industry	Public	64	42.70	72	48.00
	Private	86	57.30	78	52.00
	Total	150	100.00	150	100.00
Demographic variables		**M**	**SD**	**M**	**SD**
Age		32.8	9.10	35.70	11.30
Work experience (yrs.)		9.0	8.90	13.10	11.60

Before starting the main analyses, factor structures and reliability of the scales were tested. All the scales used in this study were unidimensional. All scales were assessed together and the result of the

confirmatory factor analysis (CFA) indicated good fit (See Table 2). Construct reliabilities of scales (CR), which lied between .75 and .95, indicated internal consistency of the dimensions (Hair, Black, Babin & Anderson, 2010). Average variance extracted (AVE) reflects the overall amount of variance accounted for by the latent construct. Fornell and Larcker (1981) favor level of .50 or above, but more than .45 is also considered reasonable (Netemeyer, Bearden & Sharma, 2003). As can be seen from Table 2, AVE of perceived risk was above .48 and all the other AVEs were above .50 threshold.

Table 2: Confirmatory factor analysis result of variables and descriptive statistics

Variables	Item #	CR	AVE	M	SD
Perceived usefulness of BCT	6	.95	.75	3.66	.78
Perceived risk of BCT	5	.82	.48	2.75	.70
Reputation of BCT	3	.75	.51	3.00	.81
Attitude towards BCT	3	.93	.82	3.79	.77
Intention to do transaction via BCT	3	.91	.77	3.44	.92

$\chi^2(160, N=300)=402.9809, p=.00$, CFI=.95, NFI=.92, TLI=.94, SRMR=.05, RMSEA=.07
CR=Construct Reliability; AVE=Average variance extracted

Descriptive statistics revealed that respondents' attitude towards blockchain technologies were quite positive except the reputation of blockchain, which was perceived just on the average with a mean score of 3 points.

Correlation analyses showed all variables were significantly correlated and significant at 99% significance level. Naturally, perceived risk was negatively related with other concepts. The magnitude of the correlations ranged from .45 to .79, indicating moderate relationships mainly. Only reputation and perceived usefulness were highly correlated (r=.79) (See Table 3).

Table 3: Correlation analyses

Variables	1	2	3	4
1. Perceived usefulness of BCT				
2. Perceived risk of BCT	-.49**			
3. Reputation of BCT	.79**	-.50**		
4. Attitude towards BCT	.46**	-.55**	.45**	
5. Intention to do transaction via BCT	.61**	-.59**	.67**	.48**

*$p \leq .05$; **$p \leq .01$; ***$p \leq .001$

After the validation and reliability test, the hypothesized model was tested. The structural equation model indicated good fit to the data (See Table 4 and Figure 1).

Table 4: The structural equation model

Paths	Standardized b	t
Reputation of BCT® Perceived usefulness of BCT	.60	9.00***
Reputation of BCT® Perceived risk of BCT	– .76	– 10.63***
Reputation of BCT® Attitude towards BCT	.09	1.06
Perceived usefulness of BCT® Attitude towards BCT	.70	11.95***
Perceived risk of BCT® Attitude towards BCT	– .18	– 2.55*
Attitude towards BCT® Intention to do transaction via BCT	.74	13.96***

χ^2(164, N=300)=459.71, p=.00, CFI=.94, NFI=.92, TLI=.93, SRMR=.07, RMSEA=.08
** $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$*

Findings indicated reputation had positive moderate effect on perceived usefulness of BCT (b=.60, p=.001) and negative strong effect on perceived risk (b=-.76, p=.001). Perceived usefulness of BCT showed strong positive effect on attitude towards BCT (b=.70, p=.001). However the effect of perceived risk of BCT on attitude towards BCT was very weak (b=-.18, p=.05). The impact of attitude towards BCT on intention to do transaction via BCT was again positive and strong (b=.74, p=.001).

Furthermore, reputation had moderate positive indirect effect on attitude towards BCT through perceived usefulness and perceived risk (b=.56) and indirect effect on intention through attitude towards BCT (b=.48)

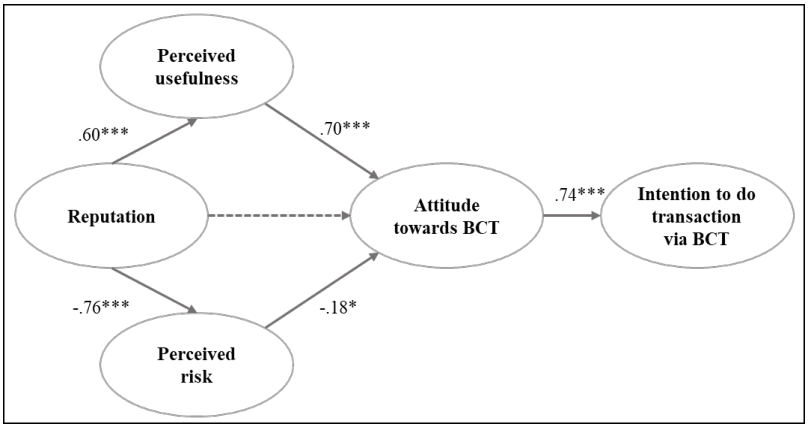

Figure 1: Structural model *(standardized coefficients presented)*

To analyze more deeply, we conducted a series of mean comparison tests to the variables with gender, education background, and type of industry.

The independent samples t-tests results indicated that there were no significant differences in respondents' perception of blockchain technologies with regard to gender and educational

backgrounds. However, except for intention to do transaction via BCT, all variables indicated significant differences based on industry types. Respondents working at private industry perceived blockchain technologies more positively compared to respondents working at public sector (See Table 5).

Table 5: Independent samples t-tests

Variables	Industry	N	M	SD	t	df	p
Perceived usefulness of BCT	Public	136	3.51	.76	-3.19	298	.00**
	Private	164	3.79	.77			
Perceived risk of BCT	Public	136	2.85	.64	2.12	298	.03*
	Private	164	2.68	.74			
Reputation of BCT	Public	136	2.87	.77	-2.63	298	.01*
	Private	164	3.12	.83			
Attitude towards BCT	Public	136	3.67	.81	-2.38	270	.02*
	Private	164	3.88	.71			
Intention to do transaction via BCT	Public	136	3.34	.98	-1.69	298	.09
	Private	164	3.52	.86			

** $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$*

The last table presents the answers given to the questions "I have done transactions using blockchain technologies" and "Do you use blockchain technologies in your job."

Table 6: Transaction via blockchain technologies?

In general			In job		
Answers	Frequency	Percent (%)	Answers	Frequency	Percent (%)
No	79	26.30	No	236	78.70
Don't know	82	27.30	Yes	64	21.30
Yes	139	46.30			
Total	300	100.00	Total	300	100.00

5. Conclusion and Discussion

Within the current digital environment, we are living in, all transactions rely on trust. Nevertheless, the question, which remains unclear, is "trust to who?" Even the ownership in most situations is not clear, the software developer? Hardware manufacturer? Service provider? Digital technologies are without boundaries, so again, comes the question to mind "which legal authorities can we turn on to?" The answer came from the digital technology itself: the blockchain technologies. BCT being a P2P public digital ledger, which cannot be changed once generated became highly popular. However, as discussed briefly BCT also has its flaws, as it is a technology, which is developing newly. Hence, it is important to understand the pros and cons of BCT to adopt as well as to develop it for the benefit of society.

Here in this paper we considered the view of working people and tried to explore drivers of BCT use. The results revealed that all hypotheses were supported except the direct effect of reputation. We found that the reputation of BCT had an indirect effect on attitude and intention to use.

Our findings also showed that respondents' intention to do transactions via BCT was quite high. This is a very promising result considering the latest reports on BCT. The technological improvements were causing a shift in the products, services, and way we do business. The COVID-19 Pandemic did not slow down these, rather accelerated the adaptation to digitalization. Especially the organizations in the finance sector are at the risk of losing their competitive advantage if they fail to adopt BCT and digital assets (Deloitte, 2021).

When their prior experience with BCT was analyzed, it is seen that 46.3% of respondents said they had used BCT, and only 21.3% had used it in their jobs.

The latest researches conducted in Turkey indicate investors to cryptocurrency are increasing even though it is still around 3% of the population (BTK, 2020; CoinGenko, 2021). Users of cryptocurrencies perceive it as a trustworthy investment tool however, even 97% of investors (N=6253) are unaware of the underlying BCT (Paribu, 2020).

In this study, we did not ask the details about transactions but considering the popularity of Bitcoin, it is very likely that respondents' experience is limited to cryptocurrencies, mainly because the experience was not work-related.

Interestingly in our findings, we could not find any difference between the perception of employees with an engineering background and business background. On the other hand, respondents working in the public sector had lower values in all positive variables and perceived more risk in BCT. Hence, we can say, people working in the public sector showed an approach that is more conservative than people working in the private sector. These also seem to support our suspicions about respondents' experience being limited to cryptocurrencies. Prior findings on financial risk tolerance and lately on cryptocurrency investment show a similar difference between public and private sector employees (Uçkun & Dal, 2021).

In the literature, the roadmap of blockchain adoption is explained in three stages: cryptocurrencies, smart contracts, and acceptance by broader society, where all stages have many technical and societal challenges (Hughes et al., 2019). We are still at the early stages and far away from the adoption of the BCT by broader society. Deloitte's blockchain report (2018) on Turkey, suggested Turkey was not as fast as the rest of the world in the adoption process. Many companies have indicated they did not have any teams working on this technology. A limited but increasing number of projects in the banking, logistic and public sectors are encouraging but not sufficient (COINTRAL, 2019; İBB 2021, TÜBİSAD, 2018; Topçu & Sarıgül, 2020).

BCT is shaping the future (Deloitte, 2020) we may be a part of this new digital future with the support of the government, arrangements in legal and tax regulations, invested efforts of organizations. However, the real competitiveness lies in taking part in the innovation and development stage.

The high mean scores in our findings point that – although in line with Deloitte's report, they do not experience BCT at their work – individuals are prone to technology and ready to embrace BCT. Bearing in mind the complexity and challenges BCT carries, it looks like the real challenge is getting people to know what these technologies are for, so that they use and apply these to new innovative business solutions.

Naturally, this study is limited with its sample, and the results should be further tested. Consequently, knowledge and awareness of BCT seem to be open to further study.

Author Contribution

CONTRIBUTION RATE	EXPLANATION	CONTRIBUTORS
Idea or Notion	Form the research idea or hypothesis	E. Serra YURTKORU Mustafa AĞAOĞLU
Literature Review	Review the literature required for the study	E. Serra YURTKORU Mustafa AĞAOĞLU
Research Design	Designing method, scale, and pattern for the study	E. Serra YURTKORU Mustafa AĞAOĞLU
Data Collecting and Processing	Collecting, organizing, and reporting data	E. Serra YURTKORU Mustafa AĞAOĞLU
Discussion and Interpretation	Taking responsibility in evaluating and finalizing the findings	E. Serra YURTKORU Mustafa AĞAOĞLU

Conflict of Interest

No conflict of interest was reported by the authors.

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