BLOCKCHAIN TECHNOLOGY AND ELECTRONIC SUPPLY CHAIN MANAGEMENT (ESCM)

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ABSTRACT

The study tried to examine to what extent technological, organizational and environmental factors influence the employees' intention to use block chain technology in the supply chain system of their companies. The study adopted the Technological, Organizational, and Environmental framework as a theoretical base. More, the structural equation modelling technique implemented to examine the proposed hypotheses. Moreover, the findings revealed that only technological and organizational factors have significant effect on employees' intention to use block chain technology in the supply chain system of their companies. Companies are highly advised to provide more support to the employees in general and those with technological competences specifically as they are expected to play a vital role in supporting the decision of block chain technology use in e-supply chain system of their companies. Furthermore, more investment in technological infrastructure as technology have strong effect on organization to accept and use block chain technology in e-supply chain system.

Keywords: *Blockchain Technology, Cryptocurrency, Electronic Supply Chain Management, Structural Equation Modeling*

1   INTRODUCTION

Nowadays no one single company can act as independent organization but rather as active partner of the long supply chain involving a wide range of businesses and relationships [1]. Therefore, this wide supply chain works in a changeable and risk vulnerable environment in addition to covering a wide range geographical areas [2], serving customers who are demanding highly customized products with competitive prices [3] taking in consideration most companies are following the rapid changes in technology to provide new and complex product to the market [4] in addition to the effect of the external environment due to economic (prices and availability of raw materials, currency exchange rates, energy cost), social (demanding customers, unrest) and natural factors such as earthquakes, tsunamis, extreme weather conditions

[5]. In order to survive in such variable environment, organizations should have high level of flexibility and resilience which give them the ability to response rapidly to such challenges [6]– [10]. In the era of Information technology [11]– [14] the Electronic supply chain management (eSCM) which considered the essential and effective enabler for traditional supply chains [3]. As it helps supply chains deal with the challenges of the changing environment. Information Technology made an essential effect on the traditional structure of supply chains in terms of internal and external integration of various processes by improving communication, acquiring and transmitting data with suppliers and customers which leads to better and effective decision-making [15]– [18].

Block chain, one of the latest IT developments, it is the technology behind the revolution of

cryptocurrency. As any other new technology there are many concerns and expected accompany risks for using block chain technology [18]– [24] as well as many different factors that may affect its adoption [25]– [32]. Block chain can play a vital role in several areas with main aim of ensuring the security and privacy [33]– [36]. Block chain has a potential to take supply chain communications to another level through simplifying the main processes of business that uses a peer-to-peer network which allow sharing and verifying the shared data. Block chain defined as distributed database system which records transactional data that secured by cryptography and governed by a consensus mechanism [37]– [41]. from this perspective it can provide security, timeliness and transparency to all its users [42].
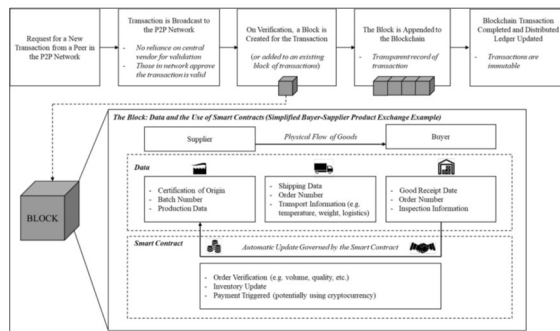

Figure 1: IBM block chain, 2018

Having along supply chain with many involved members brings another problem related to transparency among the members especially from financial aspects. Such problem is highly expected to be solved through achieving end-to-end transparency. Which in did provided by block chain. Applying block chain in supply chains might drastically change the way in which firms perform. The above-mentioned figure illustrates how a block chain works in the context of supply chain management, where each one of those blocks might have data or trigger a smart contract. The block chains, in real time, send data to the supply chain network on the sources of materials, buying orders, stores levels, items received, delivery invoices. Smart contracts do match and verifying for this data against the exist agreement and trigger the process of payment. More, other transactions can be autonomously triggered when key indicators are met like evidence of delivery [37], [43]–[49]. Our project attempts to identify the critical factors that may limit companies in sultanate of Oman to develop its own electronic supply chain management and increasing the transparency among all the chains' members using block chain technology. Therefore, the main objective is to study the readiness of Omani companies for digital transformation in of the important business process named supply chain using one of the most newly developed technology called block chain.

2 FRAMEWORK AND HYPOTHESES DEVELOPMENT

TOE has been employed to investigate employees' competence in accepting new technology and the results showed technical factors played vital role in supporting employees' adoption decision [50]. However, other studies also support the effect of non-technological factors (organizational and environmental factors) in adopting the new technology in their organization [51]– [56]. These above-mentioned studies present the importance of both technological and non-technological factors in adopting new technology from employees' perspective. Therefore, our project focused on new technology, supposed to be used by organization, is blockchain technology and e-supply chain management using this recommended framework, technological, organizational and environmental (TOE) framework.

2.1 Technological Factors

From technological perspective, adopting new technology is expected to add relative advantage, therefore, adopting block chain technology by organization and embedded it in their e-supply chain is expected to have strong effect on organization to accept this recent technology in addition to its potential competitive advantage [12], [57]–[62]. Furthermore, block chain can add more value for companies especially through reducing expected mistakes as well as make and makes all transactions more transparent which may result in reducing the total costs for the organization. Thereby, we hypothesize the following:

Technological factors have positive direct influence on employees' intention to use block chain technology in the e-supply chain of their organization.

2.2 Organizational Factors

Top management support and employee's competency have an important effect on adopting new technology especially when the competencies of technical employees are high [50], [53], [54], [59], [63]. An expected reason for that may be their direct effect and role in the decision of adopting the

new technology like block chain and e-supply chain as well as accelerating such decision [64]. Therefore, we expected that the top management in our investigated organization will play a vital role in supporting such decision and facilitating the block chain technology use in e-supply chain system of their companies. Therefore, we propose the following hypothesis:

Organizational factors have positive direct influence on employees' intention to use block chain technology in the e-supply chain of their organization.

2.3 Environmental Factors

Bloch chain technology is a new technology from implementation perspective especially in developing countries. Therefore, this area of research still new and needs more concentration. In another word, governments are expected to play an important role by regulating proper rules and laws to handle any expected issues after using such technology [65]. Furthermore, the competition also expected to have an important influence on using block chain technology in e-supply chain but still this claim needs more investigation as few studies found that this factor (competition) has insignificant effect on another new technology (i.e. cloud adoption) [51], [66]– [68]. In current study, we think that environmental factors will play a vital role in supporting the decision of using block chain technology in the e-supply chain system and facilitating it in their companies.

Hence, we propose the following hypothesis:

Environmental factors have positive direct influence on employees' intention to use block chain technology in the e-supply chain of their organization.

3 RESEARCH METHODOLOGY

The study aimed to empirically examine the effect of technological, organizational and environmental factors on employee's intention to use block chain technology in the e-supply chain of their organization. This examination will reflect the organization employees from developing country (i.e. Oman). The study targeted the employees of organizations from different industries in Oman who are using or expected to use block chain technology in their supply chain system as its population. In our project, we adopted the purposive sampling [69] as well as the type of our sample. However, through implementing two criteria in the selection of study participants.

The participant has to be:
(1) An organization employee
(2) use or expected to use block chain technology in the e-supply chain.

The study utilized the paper questionnaire-based survey to collect the targeted data from the as there was no response for the online questionnaire. All needed information was prepared and provided on the first page of the questionnaire such as the guidance about how to answer the questions and some important definitions as well as the main purpose of the study. All the methodological procedures were implemented to keep the respondents' data safe and ensure their anonymity and confidentiality. The survey is based on the TOE model. Therefore, the distributed questionnaire includes items reflect all factors of the adopted model (TOE) that developed as well as validated in the past research. The data was collected based on five-Likert scale. Technological factors were measured using items from [70]. To assess organizational factors, the scale of [70] was adopted. Wong et al., (2020) measurement was used to measure environmental factors [70]. Meanwhile the items to measure the intention to use block chain technology in supply chain system are adopted [71].

4 DATA ANALYSIS

The kurtosis and skew test was performed to confirm the normal distribution of the data, all the calculated data were between ±2 [72], [73]. Based on (Hair et al., 2019) the Partial Least Squares-Structural Equation Modeling (PLS-SEM) with Smart PLS 3 was used for examining the measurement and testing the proposed hypotheses, at the level of 5% significance [74], [75].

The whole sample are companies' employees using block chain technology in their supply chain system or the are expected to do, most of them (129) holding University degrees and 58.2% of them are males (see Table 3). To identify the model reliability and validity (convergent and discriminant).

Table 1: Factor Loading

	Tech. Factor	Org. Factor	Env. Factor	BC Adop.in eSC	VIF
T1	0.825				1.81
T2	0.798				1.74
T3	0.793				1.62
T4	0.77				1.56
O1		0.811			1.51
O2		0.808			1.55
O3		0.789			1.31

E1		0.82		1.56
E2		0.814		1.57
E3		0.852		1.62
Int1			0.868	2.04
Int2			0.873	2.13
Int3			0.81	1.50

(BC: Blockchain, ESC: Electronic Supply Chain)

The presented figures in table 1 show no factor loading problems, as well as all the values of composite reliability, Cronbach's alpha, and AVE (see table 3) all are more than recommended thresholds above their respective thresholds (0.7, 0.7, and 0.5) [76], [77]. The discriminant validity was confirmed through the Fornell-Larcker criterion (see table 2). Furthermore, cross-loading ensured that each variable act mainly on its indicators [78].

Table 2: Fornell-Larcker Criterion

	Technological Factor	Organizational Factor	Environmental Factor	BC Adoption in eSC
Tech. Factor	0.797			
Org. Factor	0.798	0.803		
Env. Factor	0.739	0.734	0.829	
BC /e-SC	0.712	0.676	0.604	0.85

(BC /e-SC: Blockchain adoption in e-Supply chain)

Further, no ensure no errors because of high correlations among the constructs the collinearity test was executed (Table 1) all the calculated values of the Variance Inflation Factor (VIF) were less (5) [16], [76], [79].

Table 3: Constructs validity

Construct	Cronbach's Alpha	CR	AVE
T	0.808	0.874	0.635
O	0.725	0.844	0.644
E	0.772	0.868	0.687
Interest to use BC in SCM	0.809	0.887	0.724

4.1 Hypothesis Test

The research findings reveal that technological and organizational factors affect positively the employees' intention to use block chain technology in the supply chain system of their companies. Hence, the first hypothesis H1 (β=0.438; p<0.01), and H2 (β=0.261; p<0.01) were supported.
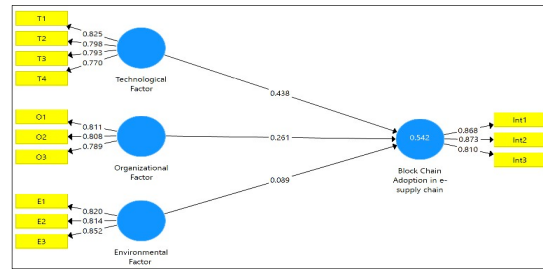

Fig. 2: Tested Frame

Our project findings reveal that technological and organizational factors affect positively the employees' intention to use block chain technology in the supply chain system of their companies. Hence, the first hypothesis H1 (β=0.438; p<0.01), and H2 (β=0.261; p<0.01) were supported. Whilst, the environmental factors have no significant influence on employees' intention to use block chain technology in the supply chain system of their companies. Thereby, the hypothesis H3 (β=0.089; p>0.01) was not supported.

Table 4 Hypotheses Test

	Path	B	T Statistics	P-value	Result
H1	Tech. Factor -> BC /e-SC	0.438	4.889	0.00	Supported
H2	Org. Factor -> BC /e-SC	0.261	2.776	0.006	Supported
H3	Env. Factor -> BC /e-SC	0.089	0.942	0.346	Not Supported

(BC /e-SC: Blockchain adoption in e-Supply chain)

5   DISCUSSION

The main objective of our project is to determine to what extent technological, organizational and environmental factors influence the employees' intention to use block chain technology in the supply chain system of their companies. The study adopted the Technological, Organizational, and Environmental framework as a theoretical base. More, the structural equation modelling technique implemented to examine the proposed hypotheses.

The result of the SEM indicate that only technological and organizational factors have significant effect on the employees' intention to use block chain technology in the supply chain system of their companies. While, the environmental factors have no significant effect on the employees' intention to use block chain technology in the supply chain system of their companies. These results

ensure that block chain can add more value for companies especially through reducing expected mistakes as well as make and makes all transactions more transparent which may result in reducing the total costs for the organization. These finding is in alignment with the previous research findings that adopting new technology is expected to add relative advantage for the companies [57]– [60].

Furthermore, the top management in the investigated organizations will play a vital role in supporting such decision and facilitating the block chain technology use in e-supply chain system of their companies. These results are in alignment with the previous research findings that top management support and employees' competency have an important effect on adopting new technology [50], [53], [54], [59].

On the other hand, in contradict with our expectations, the environmental factors did not play a vital role in supporting the decision of using block chain technology in the e-supply chain system and facilitating it in their companies, this result was in match with studies of [51], [66], [67]. Therefore, companies are highly advised to provide more support to the employees in general and those with technological competences specifically as they are expected to play a vital role in supporting the decision of block chain technology use in e-supply chain system of their companies. Furthermore, more investment in technological infrastructure as technology have strong effect on organization to accept and use block chain technology in e-supply chain system.

6 CONCLUSION

Our project tried to examine to what extent technological, organizational and environmental factors influence the employees' intention to use block chain technology in the supply chain system of their companies. The study adopted the Technological, Organizational, and Environmental framework as a theoretical base. More, the structural equation modelling technique implemented to examine the proposed hypotheses. Moreover, the findings revealed that only technological and organizational factors have significant effect on employees' intention to use block chain technology in the supply chain system of their companies.

Moreover, this research is contributed to the body of knowledge for companies that try to use block chain technology in their supply chain system. Also tried to add more understanding of using block chain technology in business especially in the e-supply chain of each company. This study among the

pioneer studies that investigated the expected factors that may influence the employees' intention to use block chain technology in the supply chain system of their companies using the structural equation modeling (SEM).

However, this study has its own limitations, the data were collected from different companies belong to different industries, as each industry has its own features and conditions therefore future research is expected to focus on one industry like banks or manufacturing industry. Moreover, the data was collected using questionnaire only and from one country this may effect on the results generalization. Hence future studies expected to use qualitative methods in addition to the quantitative once and try to collect the data from different context like GCC countries.

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