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The impacts of task technology fit, transparency, and supply chain agility on the blockchain adoption by SMEs in Jordan

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A B S T R A C T

This study aims to find out how much the ways that blockchain technology helps in different parts of the supply chain affect how SMEs use blockchain technology. Moreover, the research examines the correlation between blockchain use and overall performance. The data was obtained from the SMEs' owners and managers, who have the authority to implement blockchain technology. Two follow-up phone calls yielded 145 usable replies from 500 prospective respondents, for a response rate of 29%, which was analysed employing structural equation modelling (SEM). The results demonstrated that the contributions of blockchain adoption to task technology fit, task characteristics, technology characteristics, operational supply chain transparency, and supply chain agility influenced the acceptance intentions of SME managers and that there is a significant positive correlation between blockchain adoption and overall performance. The results aid vendors and policymakers in formulating strategies and effective plans to accelerate blockchain adoption by SMEs. Furthermore, the findings provide owners/managers of SMEs with reason to believe that blockchain technology might be a source of competitive advantage.

1. Introduction

One of the most important technologies driving the fourth industrial revolution is blockchain, which is part of a group of technologies called distributed ledgers. Due to its huge variety of positive characteristics, blockchain has the potential to revolutionize the operations of several businesses (Wamba & Queiroz, 2022). To retain their lead in the digitalization race and gain a competitive edge in a market that is both hypercompetitive and volatile, organizations of all sizes are clamoring to use blockchain technology (Queiroz et al., 2021; Aoun et al., 2021). Maybe the most significant impact of blockchain is the security of individual and corporate financial transactions (Queiroz & Telles, 2018; Maroufkhani et al., 2022; al-zoubi et al, 2023). The technology's uses extend well beyond just providing a secure payment platform (Albayati et al., 2020). Businesses, particularly small and medium-sized enterprises (SMEs), need to adapt to continue existing and expanding in the face of the disruptive pressures of Industry 4.0, globalization, and geopolitical crises (Jeble et al., 2018). They must create and implement creative business models (Morgan et al., 2020). To adapt to the altering business environment, industry leaders are implementing novel business models, including machine-as-a-service and product-as-a-service (Grida et al., 2023). SMEs lag significantly in adopting new business models, according to industry surveys (Ali et al., 2020), mostly owing to an absence of

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strategic competences and technology for organization model development. The blockchain offers SMEs exceptional potential to leapfrog the technological prerequisites for implementing similar organizational models. Moreover, Blockchain primarily does this by facilitating the streamlining of information transparency, smart contracts, financial transactions, data security, and supply chain (SC) traceability for SMEs (Shoaib et al., 2020; Garzella et al., 2021). Especially, the smart contracting aspect of the blockchain may alleviate the cash flow issue that has for so long hampered the position of SMEs in SC relationships. The smart contracting technology allows autonomous contract enforcement between consumers and business partners, offering organizations easy and fast transaction procedures (Ghobakhloo et al., 2021). The investigation of the adoption patterns of blockchain technology by SMEs is still in its infancy. (Wong et al., 2020). The earliest engagement in this area may be traced back less than two years, to when Wong et al. (2020) experimentally showed how several organizational, technical, or environmental elements, including market dynamics or perceived usefulness, can influence SMEs' decisions to develop and implement blockchain technology. Currently, the relatively low values of the assessment coefficient for the dependent factors of blockchain adoption in prior research indicate that there is still a great deal to learn about the main influence behind the shift of SMEs towards blockchain. Previous research that saw blockchain as an intra-organizational digitalization initiative may account for the inaccuracy of forecasting SMEs' desire to use blockchain technology. On the other hand, a number of industry specialists, such as Dutta et al. (2020), suggest that the usage of blockchain technology needs to be researched at the level of the SC, given that its utilize cases include the cooperative application of this technology by several supplier partners (Mohammad et al., 2023). In this light, a central company's decision to use blockchain technology may indeed depend on the extent to which this technology might help the whole SC by strengthening the operations of modern collaborative companies. Based on a 2019 analysis by Market Watch, the worldwide market for blockchain-enabled SCs is expected to reach $9.8 billion by 2025. By 2023, the worldwide contribution of block chain technology to the SC industry is projected to increase by $424 million (Hartmann et al., 2019). During the next decade, 51% of Australian businesses are anticipated to increase transparency and SC cooperation via large-scale investments in blockchain. Nevertheless, fewer than 11% of businesses are employing block chain solutions at present (Parmentola et al., 2022). As indicated by Kouhizadeh et al. (2021), one possible explanation is that knowledge-development-related blockchain technology in SCs is still in its infancy. Inadequate adoption of block chain-based SC technologies must also be addressed (Ali et al., 2020). Even though several researchers, including Kouhizadeh et al. (2021) and Grida et al. (2023), investigated the interaction involving blockchain technology and SC management, these studies highlight the larger goal of blockchain, which is to achieve competitive SC priority at the organizational level. The purpose of this research was to investigate the influence of Task Technology Fit (TTF), Supply Chain Agility (SCA), and Operational Supply Chain Transparency (OSCT) on the adoption of blockchain by SMEs, as well as to determine the relationship between adoption of blockchain and performance. This was done to address the aforementioned gap. This research makes many important contributions to the existing body of knowledge on blockchain technology. To begin, the research helps alleviate the dearth of empirical information on the effects of blockchain advantages for SCs on the adoption of blockchain technology by SMEs. Second, the results of the lone research on the factors that motivate SMEs to use blockchain, conducted by Wong et al. (2020). Lastly, this research contributes to the existing body of knowledge by examining the effects of several variables on the desire to embrace blockchain technology. The results of the research provide policymakers and blockchain suppliers with useful information that may assist them in encouraging SMEs to use blockchain technology. Furthermore, experimentally showing the benefits of blockchain technology to the SC gives a response to SMEs managers' questions about the benefits associated with investing in blockchain technology.

The remainder of the article continues as follows. The Section 2 theoretical framework for research variables is shown. Then, Section 3 describes the research methodologies, while Section 4 presents the findings and discussion. Section 5 concludes with a thorough discussion of the most important results and conclusions, including the significant limits and options for further research.

2. Literature Review

2.1 Blockchain technology

The blockchain is an asynchronous computing paradigm that utilizes a decentralized framework to store and verify chained data, as well as produce and modify data via the use of distributed concord algorithms (Grida et al., 2023). It does this by using cryptography to protect data access and transmission. It does this via the use of an automated transaction mechanism and smart contracts (Li et al., 2020). Bitcoin, the first safe cryptocurrency established by Treiblmaier et al. (2022), was the principal use of blockchain technology. To do this, blockchain technology records transactions in an immutable (Li et al., 2020), transparent, and secure way without the need for a trusted third party (Wong et al., 2020). Blockchain is capable of guaranteeing data's OSCT (Salcedo & Gupta, 2021), traceability (Chen, 2019), and integrity (Di Vaio et al., 2022). It has risen to provide a major contribution to the world of bitcoin transactions. The unique ramifications of this technology have garnered significant interest from academics and professionals (Rejeb et al., 2021; Roth et al., 2022). Nowadays, several major firms use it to improve operational efficiency (Li et al., 2020; Mohammad et al., 2023).

2.2 Task technology fit

Two key factors may impact the TTF: Task Characteristics (TC) and technological Characteristics (TCh) (Goodhue & Thompson, 1995). Technological characteristics are the interaction platforms (such as transactional data analytics tools, apps, and mobile devices) that are used to carry out certain activities. For example, mobile devices may be used to carry out particular processes. According to Tam and Oliveira (2016), if the task is depicted as time-consuming or if the information technology has fewer functionalities, the individual's motivation to use IT is believed to decrease. The degree of compatibility between tasks and technological features in the blockchain domain determines the size of the TTF. Effective task qualities have a positive effect on individuals' intentions to use blockchain technology. In contrast, poor task function decreases the desire to utilize the technology. Similarly, Lin et al. (2019) emphasize that unintended technical qualities might cause emerging technologies to be neglected or hidden. These correlations are captured by the following hypotheses:

H$_1$: *Task technology fit has a direct positive influence on blockchain adoption.*
H$_2$: *Task characteristics have a direct positive influence on blockchain adoption.*
H$_3$: *Technology characteristics have a direct positive influence on blockchain adoption.*

2.3 Operational supply chain transparency

In 2020, Dubey et al. define OSCT as "an organization's ability to interact proactively with stakeholders to make upstream and downstream SC activities visible and traceable." These experts define OSCT as the degree to which people who are part of the chain can see what is going on with items now and in the past. OSCT makes upstream and downstream activities easier to see and makes SC processes easier to understand (Duckworth, 2018). Business practices, including buying, manufacturing, logistics, and retailing, should be internally and externally linked across the SC to obtain a competitive advantage, according to Whitten et al. (2012) and Feizabadi et al. (2019). Previous research has shown that integration, trust, visibility, and information are the precursors of agility, adaptability, and alignment (Mohammad et al., 2023). It implies that a lack of trust among SC partners, a lack of visibility, and a lack of information integration are the primary obstacles to the integration and alignment of business procedures. Moreover, Dubey et al. (2020) verified the considerable impact of visibility on SC alignment. By increasing SC visibility and openness, businesses may build confidence and increase SC visibility. Ali et al. (2020) discovered that openness drives information integration, visibility, and trust. Considering the considerations, we may infer that operational SC visibility leads to chain partner alignment. As shown by Wong et al. (2020), the lack of openness throughout the SC is the primary obstacle to both internal and external alignment. Hence, we propose:

H$_4$: *Operational supply chain transparency has a direct positive influence on blockchain adoption.*

2.4 Supply chain agility

The term "SCA" refers to the capacity of the SC to alter its tactics and operations swiftly. This capability may appear both proactively and reactively. Agility refers to a company's responsiveness to short-term business changes (Gligor et al., 2015). Agility in the SC is the capacity to respond to unforeseen changes in company needs and turn them into market possibilities. An organization's agility enables it to achieve a competitive edge in unpredictable market contexts. Agility helps businesses adjust to changing market needs (Swafford et al., 2008; Gligor et al., 2015). The primary objectives of SCA are to adapt rapidly to short-term changes in supply or demand and to handle external disturbances without disruption (Di Vaio et al., 2022). Wamba & Queiroz (2022) and Duckworth (2018) urged businesses to give more thought to SC adaptability since supply interruptions and demand changes occur more often and more broadly in today's market than in the past. Typically, the SC includes operations such as product creation, manufacture, and distribution between channel partners. In order to obtain a competitive edge, the organization must collaborate with its partners to complete these connected tasks effectively while simultaneously controlling the market's volatility (Li et al., 2020). In these circumstances, SCA, which is only concerned with customer reaction due to the unpredictable nature of business (Swafford et al., 2008), is essential to the organization's competitiveness. Owing to the high degree of business unpredictability (Matawale et al., 2016), adaptability has become a critical competitive factor and a fundamental survival factor. Agility helps businesses alter cycles and adapt to new conditions (Swafford et al., 2008). Chen (2019) described how blockchain technology might increase agility, hence boosting performance and generating a competitive advantage. Addressing the significance of relative advantage in blockchain adoption (Sheel & Nath, 2019). The research suggests that SCA is a driver of blockchain adoption intent, and the following hypothesis is formulated:

H$_5$: *Supply chain agility has a direct positive influence on blockchain adoption.*

2.5 Overall Performance

When blockchain technology is successfully implemented, the whole performance of a company should increase in terms of its efficiency and effectiveness, as well as the speed at which processes are carried out and their general level of quality (Yadav & Singh, 2020). According to Whitten et al. (2012), the total performance benefit of a successful deployment of blockchain technology may be assessed by an organization's level of efficiency, effectiveness, and speed of operation. In addition to efficacy, efficiency, and automation, Shardeo et al. (2020) stressed the need for quality control and justice (to speed up the operations). Successful use of blockchain technology leads to a high speed of information flow, the elimination of the middleman, traceable smart contracts, and the simplification of operations (Yadav & Singh, 2020). The verification and validation of blockchain transactions carried out by blockchain nodes allows for the possibility of improved quality being reached.

H$_6$: *blockchain adoption is positively related to overall performance.*

3. Data Analysis

3.1 Measurement of the factors

To assess the components of the study, the researchers used the elements that had already been validated in prior research. Participants were provided with a Likert scale with five points to use while answering the questions on the survey. The scale ranged from 1 (which meant the respondent strongly disagreed) to 5 (which meant the respondent strongly agreed). The TTF model was evaluated with a nine-item scale that included all three of the following elements (Duckworth, 2018; Dubey et al., 2020): TC, TCh, and the TTF's willingness to adopt block chain. A four-item scale derived from Grida et al. (2023; Mohammad et al., 2023) was used to determine the level of acceptance of blockchain technology. The operational SC's degree of OSCT as well as its agility were each evaluated using a total of 12 criteria (Aoun et al., 2021; Mohammad et al., 2023). Lastly, a scale consisting of seven items was used to evaluate the overall performance (Mohammad et al., 2023).

3.2 Sampling and data collection

The population of the research comprises SMEs operating in the manufacturing industry. Companies in Jordan's manufacturing sector that have fewer than 200 full-time employees are considered SMEs (Ali et al., 2020). The directory maintained by the Federation of Jordanian Chambers of Commerce served as the basis for the sample frame. The information was gathered from the owners and managers of SMEs since it is up to them to determine whether or not to use blockchain technology. We made phone calls to the companies to inform them of the objectives of the study and to ascertain whether or not they were prepared to take part in the research. With return envelopes, 500 surveys were sent to the appropriate responders. After two follow-up phone calls, 145 viable replies were collected from 500 prospective responders, for a response rate of 29%. Table 1 presents the demographic characteristics of the sample. Comparable response rates were seen in investigations of Jordanian industrial enterprises employing postal questionnaires (Moutaz et al., 2020). Unfortunately, the data were susceptible to non-response bias owing to the low response rate. Hair et al. (2006) argued that the early and late replies were compared using a t-test to measure non-response rate bias. There were no statistically significant changes, indicating that non-response bias is not an issue.

Table 1
Demographic Profile

Personal background	Category	Frequency	Percentage
Operation Years	5 years below	19	13.1
	5–10 years	42	28.9
	11–20 years	51	35.1
	21 years above	33	22.7
Number of employees	5-20 employees	2	1.3
	21–50 employees	86	59.3
	51–200 employees	57	39.3
Gender	Male	112	77.2
	Female	33	22.7
Age	20–30	11	7.5
	31–40	29	20
	41–50	79	54.4
	Above 50	26	17.9
Education level	High school diploma	9	6.2
	Bachelor	98	67.5
	Master and above	38	26.2

3.4 Measurement Validity

In accordance with Hair et al. (2021), the constructs' reliability and validity were evaluated using four coefficients: average variance extracted (AVE), factor loading, Heterotrait–Monotrait correlation (HTMT), and composite reliability (CR). All item loadings were greater than 0.70 (Table 2), showing that indications are dependable. The CR and AVE values of the constructs were more than 0.5 and 0.70, showing convergent validity and adequate reliability (Hair et al., 2021). Correlations between measurements of potentially overlapping concepts indicate an item's capacity to discriminate or quantify distinct concepts. Table 3 shows the findings of the HTMT investigation. According to Henseler et al. (2015), the HTMT outcomes presented in Table 3 indicate that there are no issues with discriminant validity when the HTMT 0.85 criteria is used, which is consistent with the research's results. Hence, the HTMT criterion focuses on ensuring that latent constructs are not collinear (multicollinearity). This indicates that each component is independent of the others.

Table 2
Validity Analysis

Constructs	Items	Factor loadings	reliability	Average variance extracted
TCh	TCh1	0.753	0.891	0.796
	TCh2	0.711		
	TCh3	0.765		
TC	TC1	0.815	0.852	0.753
	TC2	0.789		
	TC3	0.808		
TTF	TTF1	0.769	0.947	0.695
	TTF2	0.758		
	TTF3	0.745		
OSCT	OSCT1	0.874	0.887	.811
	OSCT2	0.879		
	OSCT3	0.864		
	OSCT4	0.849		
SCA	SCA1	0.754		0.754
	SCA2	0.798		
	SCA3	0.852	0.867	
	SCA4	0.854		
	SCA5	0.877		
	SCA6	0.833		
	SCA7	0.814		
	SCA8	0.763		
Blockchain adoption	BCA1	0.849	0.932	0.857
	BCA2	0.873		
	BCA3	8.01		
	BCA4	0.831		
OP	OP1	0.744	0.901	0.798
	OP2	0.709		
	OP3	0.788		
	OP4	0.792		

Table 3
HTMT Analysis

	TCh	TC	TTF	TRA	AGL	OP
TCh						
TC	0.830					
TTF	0.783	0.674				
OSCT	0.781	0.520	0.557			
SCA	0.511	0.841	0.647	0.822		
OP	0.654	0.739	0.742	0.795	0.824	

3.8 Model Fit Measures

According to the suggested value, the observed values of 1121.812 for CMIN, 0.710 for PClose, 0.895 for CFI, and 0.051 for RMSEA show a satisfactory model fit in terms of absolute fit (Collier, 2020). An acceptable model fit is shown by an observed value of 0.843, 0.971, and 0.881 for AGFI, TLI, and NFI, respectively, when using incremental fit measures. A practical result of 0.826 for the parsimonious fit index (PNFI) and 0.912 for the parsimonious group fit index (PGFI) shows that the model fits very well within the specified range. Table 4 displays the outcomes of a structural testing model that was evaluated according to goodness-of-fit standards.

Table 4
Model Fit Measures

Measure	Estimate	Threshold	Measure	Estimate	Threshold
Absolute Fit Measures			Incremental Fit Measures		
CMIN	1121.812		TLI	0.971	Close to 1
DF	745		AGFI	0.843	≥ 0.90
CMIN/DF	2.357	Between 1 and 3	NFI	0.881	≥ 0.90
CFI	0.895	>0.95	Parsimonious Fit Measures		
RMSEA	0.051	<0.06	PNFI	0.826	Close to 1
PClose	0.710	>0.05	PGFI	0.912	Close to 1

3.10. Analysis Model

To validate the hypothesized connections, the structural equation modelling (SEM) methodology was put to use. The SEM is a method of multivariate analysis that is appropriate for exploratory investigations (Hair et al., 2021). The SEM technique was chosen because of the predictive value of the investigation. The validity of the measurement model in both its convergent and discriminant forms was investigated in this research. According to Hair et al. (2021), to properly evaluate the measurement model, it is necessary to ascertain the individual item reliability as well as the internal consistency, content, convergent validity, and discriminant validity of the measurements. To demonstrate convergent validity, factor loading, composite reliability, and average variance extracted (AVE) were all evaluated. The results provide support for the scales. The test statistic known as critical value, or CR, is used to determine whether the parameter estimates generated by SEM are statistically significant. It is calculated by dividing the parameter estimate by the standard error of the parameter estimate. This is how it is defined (SE). For the CR value to be considered significant at the 0.05 level, it must be 1.96 or higher (Collier, 2020). If this parameter has a value that is less than this, then its contribution to the performance of the model might be disregarded as irrelevant. The data shown in Table 5 indicate that the assumptions posed by the following research model (Figure 1) may be accepted. As can be seen in Table 5, the implementation of blockchain technology has a statistically significant and favorably impactful influence on the TTF (0.29), TC (0.25), TCh (0.26), OSCT (0.12), and SCA (0.22). Also, the findings revealed that the use of blockchain technology influenced the overall performance (0.09) (Table 5).

Table 5
Regression Weights for blockchain adoption

		Estim	**S.E.**	**C.R.**	P	**Beta**
TCh	Adoption	0.394	0.044	11.557	***	0.26
TC	Adoption	0.374	0.041	11.656	***	0.25
TTF	Adoption	0.377	0.045	11.528	***	0.29
OSCT	Adoption	0.018	0.05	5.117	***	0.12
SCA	Adoption	0.114	0.039	7.576	***	0.22
OP	Adoption	0.419	0.07	6.254	***	0.09

4. Discussion

The concepts of blockchain adoption literature served as the foundation for our research, with a particular focus on TTF, TC, TCh, OSCT, SCA, and overall performance (Mohammad, et al., 2023; Whitten et al. 2012). We first constructed and then experimentally tested a conceptual study framework with the goal of forecasting the human behavior that lies behind the adoption and use of blockchain technology. To the best of our knowledge, there is a dearth of fresh blockchain adoption research that takes a multi-mode integration strategy or pattern within the existing body of scholarly work on IT adoption and SC management. Hence, in order for our model to effectively predict behavioral intents and expectations for the adoption of block chains in the SC domain, we have to include new constructs. In addition, the findings provide further evidence that the efficiency of blockchains and the degree to which tasks are suited to certain technologies are two of the most crucial elements in determining whether blockchain technology will be adopted. This is confirmed by past studies, including those found in (Chen, 2019; Dutta et al., 2020), which utilized the efficiency of blockchain technology to forecast the intention to embrace blockchain technology in Burundi's coffee SC. The task–technology fit has been used to predict the uptake of various technologies in other research, including mobile payment technology, mobile banking, and mobile learning (Moutaz et al., 2020; Dubey, et al., 2020; Ali et al., 2020). Given the assumption that employing block chain technology in the SC sector might increase safety, sustainability, OSCT, and traceability, this outcome is to be anticipated. In addition, users' intentions to use new technology increase in proportion to the degree to which they profit from it and make improvements to their performance. The results provided more evidence that the desire to embrace blockchain technology is influenced by the OSCT and agility of SCs. These findings agree with those observed by Wong et al. (2020), who discovered that relative advantage was a factor in the adoption of blockchain technology among SMEs. In the volatile and unpredictable market that exists today, where demand shifts and supply interruptions occur on a regular basis, adaptability is a critical component of a successful competitive strategy (Matawale et al., 2016). The flexibility of the SC allows businesses to react quickly to changes in the market (Gligor et al., 2015). In addition, the present complicated SC networks may be impacted by a lack of trust, information integration, and visibility, which can have a negative effect on SC performance and efficiency (Maroufkhani et al., 2022). The elimination of trust, information integration, and visibility problems may be accomplished via OSCT (Duckworth, 2018). Consequently, as advantages of using blockchain technology, OSCT and agility ensure the firm's competitiveness and drive small and medium-sized businesses to utilize blockchain technology. The findings of the data analysis show that the p value is 0.000 0.050, which allows one to draw the conclusion that there is a positive and significant association between overall performance and use of blockchain technology. These findings are consistent with those found in the studies conducted by Grida et al., (2023), Feizabadi et al., (2019), and George et al. (2021). There are further studies that indicate a good and substantial association exists between general performance and the use of blockchain technology (Khanfar et al., 2021).

5. Conclusion

In the following piece, we set out to answer the question, “What is the acceptance or adoption of block chain-based SC technology in the context of Jordan?” by providing some insight into this topic. To do this, we have provided a model for the adoption of block chain that is based on a slightly modified version of the TTF, TC, TCh, OSCT, SCA, and overall performance. After that, structural equation modelling was used to conduct the measurements on the final model (SEM). There are four different ways in which this research contributes to the existing body of knowledge. Secondly, it creates a more complex and specific model that investigates the direct elements for understanding the behavior of SMEs interested in adopting block chain technology in the SC industry. Second, it provides data that is based on the real world to back up the model that was hypothesized. Finally, the study fills a hole in the existing research by applying the conceptual model to cross-sectoral SCs in Jordan. This fills a gap in the existing research. Fourth, the results give valuable insights to managers who are involved in blockchain adoption initiatives. One example of these insights is the consideration of TTF, which the research revealed to have an influence on blockchain adoption in Jordan. This research makes significant additions to the literature and practice by highlighting the roles of blockchain SC advantages in encouraging SMEs to embrace this disruptive technology. Considering the advantages of blockchain technology and the low degree of acceptance among SMBs, our research was capable of making these major contributions to both the literature and practice.

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