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Blockchain, transparency and trust in supply chains: Insights from professionals' perceptions

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Background: Blockchain technology (BCT) is widely recognised for its potential to transform supply chain (SC) operations by enhancing SC transparency, hence fostering trust among SC partners. However, most empirical research has explored its direct impact through conceptual and causal models, while limited studies have explored how SC professionals themselves perceive the role of BCT in strengthening SC transparency and trust among SC partners, especially within emerging economies.

Objectives: This study explores the perceptions of SC professionals regarding BCT technology, SC transparency and trust. The focus is on understanding how practitioners interpret the relational value of BCT in the context of emerging economies, with Egypt serving as a representative case.

Method: This study employs an exploratory quantitative research approach through a quantitative method that utilises surveys to collect data from 63 SC professionals working in organisations operating in Egypt.

Results: Findings confirm that professionals perceive BCT as a tool that positively influences both SC trust and SC transparency, with SC transparency partially mediating the relationship between BCT and trust. However, SC transparency alone does not fully explain trust-building, highlighting the importance of other BCT features such as immutability, traceability and smart contracts.

Conclusion: This study reveals that SC professionals in emerging economies perceive BCT as a multifaceted trust-enabling mechanism, operating through SC transparency and other technological affordances.

Contribution: By capturing practitioners' perceptions, this study offers exploratory observations about the perceived relationship among BCT, SC transparency and trust, offering evidence-based understanding from an emerging economy perspective. The findings inform both academics and managers on how BCT's perceived benefits can shape future trust-oriented SC practices.

Keywords: blockchain technology; supply chain transparency; supply chain trust; emerging economies; perceptions.

Introduction

Since the emergence of Bitcoin, a digital cryptocurrency, in 2008, blockchain technology (BCT) has garnered significant attention from various researchers and practitioners, becoming a central point of interest (Dabbagh, Sookhak & Safa 2019). Blockchain technology is a digital ledger that is designed to be resistant to tampering, as it is implemented in a decentralised manner, meaning there is no central authority controlling it (Yaga et al. 2019). Hence, BCT is considered an innovative and potentially transformative technology that has the capacity to revolutionise the global supply chain (SC) (Biggs et al. 2017; Vazquez Melendez, Bergey & Smith 2024).

Storing decentralised records on a BCT platform increases transparency in the flow of process status information, leading to enhanced operational efficiency and enhanced performance for the whole SC (Centobelli et al. 2022; Francisco & Swanson 2018). Supply chain transparency is described as the combination of visibility and information sharing, enabling a clear view of the entire SC, which is essential for effectively managing and controlling global SC (Zelbst et al. 2020). However, despite the technological advancements, a lack of trust among SC partners continues to hinder collaboration, information sharing and joint decision-making (Hellani et al. 2021).

Recent studies in the field propose that distributed ledger technologies, particularly BCT, have the potential to enhance trust and facilitate trade in environments where trust is lacking (Baharmand, Maghsoudi & Coppi 2021). Blockchain technology fosters and enhances trust by increasing transactional transparency, ensuring data immutability and reducing information asymmetry (Meidute-Kavaliauskiene et al. 2021). Fortunately, empirical evidence on how these mechanisms interact remains limited, especially within emerging economies where institutional voids and relational uncertainties persist.

Organisations are still uncertain about accepting the high cost of implementing BCT because benefits on the SC have not yet been proven (Ghode et al. 2020). Adopting BCT should involve a comprehensive evaluation that includes all SC partners (Baharmand et al. 2021). Therefore, it is important to understand how SC professionals perceive BCT's role in fostering transparency and trust across SC networks.

Accordingly, this paper aims to examine the effect of BCT on SC trust among SC partners through the mediating role of SC transparency. Drawing on the perceptions of SC professionals operating in Egypt, this research uses quantitative methods using a survey to statistically assess the proposed relationships. By capturing professionals' perceptions from emerging context, the study provides both theoretical and empirical insights into how BCT's transparency-enhancing features can strengthen trust among SC partners.

The remainder of the paper is organised as follows: Section 'Conceptual foundation' presents a comprehensive review of relevant literature on BCT, SC transparency, and trust, establishing the theoretical foundation for the proposed framework and hypotheses. Section 'Research methodology' outlines the research methodology, including the data collection process, measurement instrument, and analytical techniques employed. Section 'Results and analysis' presents the results of the empirical analysis, followed by section 'Discussion', which discusses the key findings in relation to existing literature. Finally, section 'Conclusion and future recommendation' concludes the paper by summarizing the main contributions, outlining managerial and theoretical implications, and suggesting directions for future research.

Conceptual foundation

Blockchain technology

A widely recognised definition of BCT, coined by Don and Alex Tapscott, states that it is a secure and unchangeable digital record of transactions that can be programmed to not only store financial transactions but also any valuable information (Golosova & Romanovs 2018). Initially, BCT was recognised as a platform for overseeing Bitcoin – a digital cryptocurrency – but it has now evolved beyond mere currency management into a novel computing and information flow paradigm, which carries extensive implications for the future advancement of SC management (Saberi et al. 2019).

Blockchain technology has various types such as public blockchain (BC) and private BC. The public BC is a decentralised and inclusive ledger system that operates without any restrictions or permissions, allowing anyone with access to the network to be authorised and obtain data or be a part of the chain (Paul et al. 2021). Prominent examples of public blockchains include Bitcoin and Ethereum, among others (Komalavalli, Saxena & Laroiya 2020). Private blockchains emerged to improve performance and exercise more control over users (Ghiro et al. 2021). Private BC operates as a permissioned ledger, limiting access solely to selected participants within the network (Komalavalli et al. 2020). Experts suggest that private BCs can be implemented in various use cases such as voting systems and SC management (Paul et al. 2021).

The SC field presents a typical application for BCT, as BCT can change the whole chain, providing a more transparent and collaborative SC, building trust and improving security (Niu & Li 2018). Blockchain technology has the potential to address numerous challenges currently encountered by SCs, particularly those related to information traceability and security (Lim et al. 2021).

Supply chain transparency and trust

Supply chain is a network of interconnected organisations engaged in various processes and activities, both upstream and downstream, that create value in the form of products and services delivered to the end consumer (Stadtler 2014). Thus, SC management involves the coordination and control of resources such as materials, finances, personnel and information, both internally and across the SC, with the aim of optimising customer satisfaction and gaining a competitive advantage over rivals (Shukla, Garg & Agarwal 2011).

Supply chain transparency refers to the act of a company providing information to all SC partners, which includes suppliers, distributors, consumers and even investors (Sodhi & Tang 2019). Enhanced SC transparency usually invites public scrutiny and pressures the SC partners but also enables organisations to monitor overall performance across the SC and address specific issues such as suppliers' sustainability, hence improving SC sustainability (Chen, Zhang & Zhou 2019).

Supply chain success relies on a strong level of trust and a deep commitment among SC partners (Kwon & Suh 2004). Yet SC trust presents a multifaceted challenge, as it is difficult to attain trust within SC networks, as such networks are frequently intricate, involving numerous partners with a wide array of products (Kshetri & Voas 2019). Then, to build trust, it is crucial to facilitate transparency throughout the SC, enabling individuals and companies to track the origins of their products along with any kind of information related to these products (Hellani et al. 2021).

Effect of blockchain technology on supply chain transparency and trust

The utilisation of BCT in SC ensures the security and accessibility of information, leading to the transparent sharing of information among SC partners (Zelbst et al. 2019). Furthermore, investing in emerging SC transparency technologies like BCT allows organisations to achieve improved visibility among SC partners' activities, which can minimise risks within the SC, resulting in greater efficiency (Montecchi, Plangger & West 2021).

Blockchain technology reliability and transparency would influence material and information flow among SC partners, offering a major rethinking of SC current practices (Saberi et al. 2019). Hence, multiple big consumer goods organisations are currently exploring the adoption of BCT to benefit from its traceability and transparency advantages, such as Walmart teaming up with Nestle, Dole, Unilever and Tyson to test 'farm to table' blockchain system. Also, Carrefour is testing the adoption of blockchain in organic foods SC (Chang, El-Rayes & Shi 2022). And based on a study by Wang et al. (2019) – interviewing SC experts to acquire insights about BCT implementation within the SC field – experts suggest that implementing BCT into SC would lead to secured information sharing, hence building trust between SC partners. Academic literature predominantly discusses the BCT theme in relation to traceability, emphasising its advantages and importance in enhancing transparency, quality and sustainability across SCs (Vazquez Melendez et al. 2024).

Blockchain technology is composed of interconnected encrypted blocks, where created blocks cannot be altered or deleted without breaking the chain on the network, which ensures transparency and trust over the network (Gurtu & Johny 2019; Queiroz, Telles & Bonilla 2020). All network participants have the same copy of a ledger containing a list of transactions, allowing for auditability, traceability and ensuring fairness and ease of access to data within the network (Kouhizadeh & Sarkis 2018). Such transparency creates trust and reduces fraud; additionally, users can choose to either remain unidentified or provide identification (Wang et al. 2019). As such, transparency facilitates the traceability of information across multiple nodes and creates a technology-based trust among a group of parties (Agrawal et al. 2021). Furthermore, such enhanced transparency can lead to enhanced consumers' trust in the organisation, which is considered a valuable competitive advantage (Lim et al. 2021).

Nevertheless, debates continue regarding how contextual and institutional constraints shape BCT's role in emerging economies. While most studies focus on the positive implications of BCT for SC transparency and collaboration, other papers highlight that regulatory, cultural and infrastructural factors may moderate BCT effectiveness (Sahoo et al. 2024; Tokkozhina, Martins & Ferreira 2022). Hence, addressing these contextual complexities is essential for extending BCT theory beyond developed economy perspectives and ensuring deeper understanding of its effect on SC trust and SC transparency.

Research problem

Over the years, SC systems enabled by BCT have received significant attention from both researchers and practitioners, considering it one of the most promising technologies for providing traceability-related services in SCs (Dasaklis et al. 2022). Although significant changes can be achieved by implementing BCT with SCs, resistance to change, transparency and trust are critical factors in deciding whether SC stakeholders would take up BCT, as these factors shape the acceptance and universal adoption of BCT in SC (Kumar et al. 2025). Likewise, BCT implementation in SC still requires a rigorous academic investigation to understand the extent to which it creates value for the organisations (Tokkozhina et al. 2022). Many companies are still uncertain about the high cost of implementing BCT because the efficiency and benefits in the SC sector have not yet been proven (Ghode et al. 2020). Recently, despite executives recognising trust as central to successful SC operation, global SCs across numerous industries are experiencing issues of trust deterioration, hence shifting the focus of firms worldwide towards the significance of technology-based trust-building solutions such as BCT (Yavaprabhas, Pournader & Seuring 2023). Nonetheless, there remains a need for further research to examine how BCT enhances trust, traceability and transparency within organisations (Centobelli et al. 2022).

Additionally, as most of the existing literature about BCT adoption in SCM primarily focuses on developed economies, the need for more research on the value of BCT in emerging countries is encouraged (Sahoo et al. 2024). Furthermore, Kamble, Gunasekaran and Arha (2020) stated that the context of different countries may result in varying significant outcomes related to BCT implementation in SCs. Thus, this research examines how BCT affects trust among SC partners, with SC transparency serving as a mediating factor. Drawing on the perceptions of SC professionals operating in Egypt, this research uses quantitative methods using a survey to statistically assess the proposed relationships. By capturing professionals' perceptions from emerging context, the study provides both theoretical and empirical insights into how BCT's transparency-enhancing features can strengthen trust among SC partners. Although some previous articles have studied some emerging economies such as Turkey, Malaysia, India, Thailand and Brazil, multiple differences exist between Egypt and these countries in terms of technology readiness and innovation (Zayed & Yaseen 2025).

In accordance with the previously mentioned research objective, the conceptual framework is presented in Figure 1, and the developed hypotheses are presented as follows:

- **H1:** There is a relationship between blockchain technology and supply chain trust.
- **H2:** There is a relationship between blockchain technology and supply chain transparency.

H3: There is a relationship between supply chain transparency and supply chain trust.

H4: Supply chain trust mediates the relationship between blockchain technology and supply chain transparency.

Research methodology

This study aims to explore how BCT affects trust among SC partners, specifically examining the mediating role of SC transparency. To achieve this, it adopts an exploratory research approach using quantitative methods, including surveys to gather data from SC-industry experts and professionals in organisations operating in Egypt.

A quantitative approach is used to collect data from large samples, which helps determine larger populations and can identify trends and relationships that may not be apparent through qualitative methods (Fryer, Larson-Hall & Stewart 2018). And as mentioned by Gerrish and Lacey (2010), quantitative data research refers to a research design and methodology that produces numerical data. Data were collected through a survey that was developed based on validated items from prior articles. Ensuring all of the three constructs' measurement items are carefully selected to fit in the conceptual research model presented in Figure 1 and satisfy the research objective, items for each construct are presented in Table 1.

The survey was composed of three constructs; the first construct is BCT composed of three items adopted from Queiroz and Wamba (2019). This construct was designed to measure respondents' perceptions of BCT's role and benefits in SC operations rather than their organisation's readiness or stage of adoption. These items reflect how professionals perceive key features of BCT as mechanisms that enhance SC performance. Thus, the construct captures perceived influence rather than technological adoption levels.

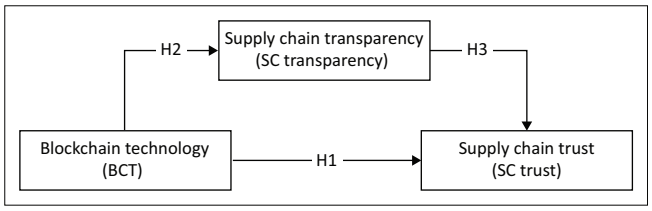

FIGURE 1: Conceptual framework of this study.

While the second construct is SC trust, composed of four items adopted from Doney and Cannon (1997), the original framework of this paper was not related to BCT; it provided a robust theoretical basis for understanding trust in collaborative relationships. To contextualise this construct for the current study, we integrated the technological dimension of BCT by developing items that reflect how professionals perceive BCT. Thus, the construct combines the general principles of interorganisational trust from existing literature with BCT-specific elements designed by the authors. The resulting items are expected to measure perceived trust potential, focusing on how BCT will influence trust with SC partners rather than computing observed trust behaviours.

The third construct is SC transparency, composed of three items adopted from Queiroz and Wamba (2019) as well. This construct was developed to capture respondents' perceptions of how BCT influences information visibility and sharing among SC partners. Items were phrased in perceptual and hypothetical terms – using 'would' or 'can' – to reflect professionals' beliefs about BCT's potential effect rather than its realised outcome, which is aligned with the study's exploratory and perception-based approach. All survey items utilised a Likert scale consisting of four options: strongly agree (5 points), agree (4 points), disagree (3 points), neutral (2 points) and strongly disagree (1 point). Additionally, some classification questions were asked such as job title, years of work experience in the field of SC, industry and organisation size.

The target population consists of SC professionals working in organisations operating in Egypt, and the final sample size for this study was 63 respondents. The sampling technique

TABLE 1: Items used in survey.

Construct	Source	Measurement item
Blockchain technology (BCT)	Queiroz and Wamba (2019)	• BC1: I find BCT useful in our SC processes. • BC2: As an organisation, we might consider using BCT in SC processes. • BC3: As an organisation, we are planning to use BCT in SC processes.
Supply chain trust (SC trust)	Combines the general principles of interorganisational trust from existing literature (Doney & Cannon 1997) with BCT specific elements designed by the authors.	• T1: Using BCT in SC will increase our trust in SC partners. • T2: Using BCT in SC can help us believe the information that the vendor provides us. • T3: Implementing BCT in SC practices can contribute to building trust with vendors. • T4: Using BCT will make suppliers trustworthy.
Supply chain transparency (SC transparency)	Queiroz and Wamba (2019)	• Tr1: I believe BCT enabled-SC processes would be transparent. • Tr2: I believe using BCT in SC will provide me with in-depth knowledge about my SC partners' activities. • Tr3: I believe using BCT in SC allows deeper access to improve my understanding of how our SC partners work.

Note: Please see the full reference list of the article, Zayed, E.O. & Hatem, M., 2026, 'Blockchain, transparency and trust in supply chains: Insights from professionals' perceptions', *Journal of Transport and Supply Chain Management* 20(0), a1255. https://doi.org/10.4102/jtscm.v20i0.1255, for more information.

BCT, blockchain technology; SC, supply chain.

employed in this research includes the use of nonprobability sampling methods, specifically convenience sampling and snowball sampling.

Online survey using Google Forms was used for data collection, and participants were reached through professional social networking websites such as 'LinkedIn' with follow-up messages and emails. Online surveys are considered beneficial for collecting many responses in a short time interval with lower expenses than traditional paper-based surveys (Kamble et al. 2019; Sekaran & Bougie 2013). For this research study, a final sample of 63 SC professionals was reached, and according to the rules of thumb of 10 observations per construct, such sample size is considered sufficient. The study includes respondents with diverse professional backgrounds as presented in Table 2. Their varied experience stems from differences in industry sectors, years of experience, and the size of their respective organisations, providing a well-rounded perspective on BCT's effect on SC trust and transparency.

The data analysis section of this utilises quantitative data and regression analysis. Regression analysis is a statistical technique used to explore and examine the connections and associations between variables (Sykes 1993). This approach allows for the examination of relationships between variables and the assessment of the effect of independent variables on the dependent variable. In quantitative data analysis, researchers have a range of statistical tests to choose from based on the type of data collected and the hypotheses being tested. For this particular research, the IBM SPSS (Statistical Package for Social Sciences) Statistics 19 software was used for quantitative analysis. Statistical Package for Social Sciences is a widely recognised programme developed by IBM that offers data management capabilities and facilitates various statistical analyses, ranging from simple descriptive statistics to more advanced inferential and multivariate procedures (Sekaran & Bougie 2013).

TABLE 2: Respondents' professional backgrounds (N = 63).

Characteristics	Category	*n*	%
Working experience in the field of SCM (in years)	2–5	5	8
	5–7	22	35
	7–10	19	30
	> 10	17	27
Job title	SC director	12	19
	Logistics Manager	6	10
	Procurement Manager	7	11
	Material Planning Manager	10	16
	Operations Manager	11	17
	Foreign Purchasing Manager	6	10
	SC Innovation Manager	7	11
	Chief Executive Officer	4	6
Industries	Food and beverages	27	43
	Logistics	6	10
	Heavy material manufacturing	10	16
	Pharmaceuticals	20	32
Company size (based on number of employees)	Small (0–100)	10	16
	Medium (100–500)	25	40
	Large (500–1000 and more)	28	44

SCM, Supply Chain Management.

After finalising the data collection, the first step was to conduct reliability testing by assessing interitem consistency using Cronbach's coefficient alpha. Next, analysis was conducted to confirm the relationship between variables such as correlation analysis through developing a correlation matrix using the Pearson correlation matrix (Hatem & Zayed 2024). Finally, to test the significance of relationships between independent variables and dependent variables explained in the developed conceptual framework of this research study, simple and hierarchical regression was performed (Hatem & Zayed 2024).

Ethical considerations

Ethical clearance to conduct this study was obtained from the Faculty of Economics and Business Administration of German International University.

This study has been reviewed and approved for ethical compliance by the Dean of Faculty of Economics and Business Administration. The study has been found to meet the ethical standards of German International University and adheres to recognized principles for conducting research involving human participants. The researcher has ensured that participation was voluntary, informed consent was obtained where applicable, and confidentiality and data protection measures were properly observed.

Results and analysis

Reliability testing

Cronbach's alpha was conducted on the responses of the first 15 participants in order to assess the interitem consistency reliability of the developed instrument and determine its reliability. The interitem consistency reliability assesses how consistently respondents answer all items in a measure, with one of the most powerful tests being Cronbach's alpha (α). This reliability coefficient indicates the degree of correlation among items in a set; the closer Cronbach's alpha is to 1, the better the reliability. Values below 0.60 are considered poor, those in the 0.70 range are acceptable, and those above 0.80 are good (Sekaran & Bougie 2013).

After reaching 15 respondents – exceeding 10% of the targeted sample size as recommended by Kim and Shin (2019), some statistical pilot tests were performed such as a test of interitem consistency reliability using the Cronbach's coefficient alpha.

TABLE 3: Cronbach's alpha reliability coefficient.

Items	Number of items	Cronbach's alpha value	
		N = 15	N = 63
All items	10	0.91	0.91
First construct – Blockchain technology	3	0.86	0.82
Second construct – Supply chain trust	4	0.93	0.89
Third construct – Supply chain transparency	3	0.32	0.58
	2 (if-item-deleted)	-	0.74

Presented in Table 3, the Cronbach's alpha value for the first pilot testing – 15 respondents – as well as the Cronbach's alpha value for each construct is provided as well. Results showed that the instrument used is suitable for the research objective and statistical proportions do exist, as all the Cronbach's alpha values for all items are 0.914 exceeding the 0.7 acceptable range proving the reliability of the test. Additionally, all constructs have values exceeding 0.7 except for the third construct (SC transparency). However, this can be justified by the small sample size for pilot testing. Hence, further reliability investigation is conducted after finalising data collection to ensure enhanced reliability before proceeding with data analysis.

In Table 3, the reliability analysis results after finalising the data collection phase were presented using the whole data set of 63 respondents. The Cronbach's alpha value for all items included in this measure is 0.908, which indicates that all the measurement items are highly reliable. Additionally, by investigating each construct's Cronbach's alpha reliability coefficient, it was confirmed that the first two constructs – blockchain technology and SC trust – have values around 0.8, which confirms the reliability of these constructs as well and the appropriateness of adding these items together to formulate the construct. Yet regarding the third construct (SC transparency), Cronbach's alpha value of 0.579 is questionable for this construct. After analysing the *if-item-deleted* Cronbach's alpha, it was decided to remove the first item, and this adjustment led to an increased Cronbach's alpha value of 0.737, hence confirming the construct.

Correlation analysis

To confirm the relationship between variables, correlation analysis was performed through developing a correlation matrix using the Pearson correlation matrix through IBM SPSS Statistics 19 quantitative analysis software (Hatem & Zayed 2024). The Pearson correlation matrix is helpful to interpret the strength of the relationship between interval variables, its direction, as well as the significance of such a relationship (Sekaran & Bougie 2013). Through calculating the Pearson correlation coefficient, the results are interpreted following the guidelines of Hinkle, Wiersma and Jurs (2003). The Pearson correlation coefficient was used to examine the relationship between BCT as an independent variable and SC trust and SC transparency as dependent variables, as well as the relationship between SC transparency as an independent variable and SC trust as a dependent variable (Hatem & Zayed 2024).

TABLE 4: Pearson correlation results.

Variable	Sub-variable	Supply chain trust	Supply chain transparency
Blockchain technology	Pearson correlation	0.92**	0.40**
	Sig. (two tailed)	0.00	0.00
	N	63	63
Supply chain transparency	Pearson correlation	0.43**	1
	Sig. (two tailed)	0.00	-
	N	63	63

**, Correlation is significant at the 0.01 level (two tailed).

As presented in Table 4, results showed that there was a strong positive significant correlation between BCT and SC trust ($r = 0.922$, $p = 0.000$). Also, results showed that there was a moderate positive significant correlation between BCT and SC transparency ($r = 0.401$, $p = 0.001$). In addition to that, results confirmed that there was a moderate positive significant correlation between SC transparency and SC trust ($r = 0.427$, $p = 0.000$).

Regression analysis: Hierarchical regression

Finally, both hierarchical regression and simple regression were performed to test the significance of the relationships between the independent and dependent variables as outlined in the developed theoretical framework, allowing for a conclusion regarding this research hypothesis. Hierarchical regression was performed to test whether SC transparency mediates the relationship between BCT and SC trust – testing H1, H2 and H4 – and results are presented in Table 5, Table 6 and Table 7.

The ANOVA table presented in Table 6 confirms that the regression model is statistically significant, indicating that both BCT and SC transparency are key variables influencing SC trust. The significance of the model suggests that these two factors play a crucial role in shaping trust dynamics with SC relationships.

Furthermore, the model summary reveals that in the presence of SC transparency, the R^2 value of the model has increased slightly from 0.850 to 0.854. This suggests that 85.4% of the variation in SC trust can be explained by the combined effect of BCT and SC transparency, which is offered or enhanced by such technology. Although the increase in R^2 value is modest, it indicated that SC transparency adds incremental explanatory power to the model, reinforcing its role as a contributing factor in enhancing trust with SC. These findings emphasise the importance of integrating BCT to foster trust among SC partners, potentially through improved collaboration, reduced information asymmetry and enhanced operational efficiency.

Additionally, in the presence of SC transparency, the direct relationship between BCT and SC trust slightly weakened

TABLE 5: Hierarchical regression: Model summary.

Model	*R*	*R* square	Adjusted *R* square	Standard error of the estimate	Durbin-Waston
1	0.92†	0.85	0.85	0.28	-
2	0.92‡	0.85	0.86	0.28	1.98

Note: Dependent Variable: SC Trust.

†, Predictors: (Constant), BCT; ‡, Predictors: (Constant), BCT, SC Transparency.

as shown in the coefficients Table 7 – Beta = 0.922, $p = 0.000$ in Model 1 and Beta = 0.895, $p = 0.000$ in Model 2. However, in both cases, the relationship remained statistically significant, indicating that SC transparency serves as a partial mediator in the relationship between BCT and SC trust.

Therefore, the following hypotheses are supported; H1 'There is a relationship between blockchain technology and supply chain trust', H2 'There is a relationship between blockchain technology and supply chain transparency' and H4 'Supply chain trust mediates the relationship between blockchain technology and supply chain transparency'.

Regression analysis: Simple regression

While testing for the relationship between SC trust and SC transparency – testing for H3 – simple regression was conducted, and results for simple regression are presented in Table 8 and Table 9.

The results of the simple regression analysis between SC transparency and SC trust demonstrated statistical significance, with an R^2 value of 0.182. This indicated that approximately 18.2% of the variance in SC trust can be explained by SC transparency, suggesting that increased transparency within the SC contributes to greater trust among stakeholders. While this percentage reflects a moderate explanatory power, it highlights the role of transparency as a contributing factor to building trust within SC relationships.

Thus, these findings provide empirical support for H3 'There is a relationship between supply chain transparency; and supply chain trust'. Reinforcing the notion that enhancing transparency mechanisms such as real-time data sharing, traceability and open communication can positively influence the trust dynamics between SC partners.

Discussion

The statistically significant findings of this research can be categorised into four main themes: firstly, the direct relationship between BCT and SC trust; secondly, the direct relationship between BCT and SC transparency; thirdly, the direct relationship between SC trust and SC transparency and fourthly, the partial mediation role of SC transparency on BCT and SC trust (Hatem & Zayed 2024).

TABLE 6: Hierarchical regression: ANOVA.

Model	Variable	Sum of squares	*df*	Mean square	*F*	Sig.
1	Regression	27.23	1	27.23	346.88	0.000†
	Residual	4.79	61	0.08	-	-
	Total	32.01	62	-	-	-
2	Regression	27.35	2	13.68	176.09	0.000‡
	Residual	4.66	60	0.08	-	-
	Total	32.01	62	-	-	-

Note: Dependent variable: SC trust.
†, Predictors: (Constant), BCT; ‡, Predictors: (Constant), BCT, SC Transparency.
df, degrees of freedom; Sig., significance.

TABLE 7: Hierarchical regression: Model coefficients.

Model	Variable	Unstandardised coefficients		Standardised coefficients: Beta	*t*	Sig.
		Beta	Standard error			
1	(Constant)	0.37	0.21	-	1.78	0.08
	BCT	0.93	0.05	0.92	18.62	0.00
2	(Constant)	-0.03	0.38	-	-0.08	0.93
	BCT	0.91	0.05	0.89	16.64	0.00
	SC transparency	0.12	0.09	0.07	1.28	0.20

Note: Dependent variable: SC trust.
Sig., significance.

TABLE 8: Simple regression: Model summary.

Model	*R*	*R* square	Adjusted *R* square	Standard error of the estimate	Durbin-Waston
1	0.43†	0.18	0.17	0.65	2.36

Note: Dependent variable: SC trust.
†, Predictors: (Constant), SC transparency.

TABLE 9: Simple regression: ANOVA.

Model	Variable	Sum of squares	*df*	Mean square	*F*	Sig.
1	Regression	5.84	1	5.84	13.62	0.000†
	Residual	26.17	61	0.43	-	-
	Total	32.01	62	-	-	-

Note: Dependent variable: SC trust.
†, Predictors: (Constant), SC transparency.
Sig., significance.

Firstly, regarding the direct relationship between BCT and SC trust, the findings of this research suggest that the implementation of BCT in SC has a significant and positive effect on SC trust. This highlights the role of BCT and a key predictor of trust within SC relationships. By providing tamper-proof record-keeping, enhanced security and increased visibility, BCT fosters a more trustworthy environment where SC partners can engage in transactions with greater confidence. Additionally, the decentralised nature of BCT, combined with its ability to ensure data integrity and prevent unauthorised alterations, builds a foundation for enhanced mutual trust among SC partners. Such findings align with the argument by Centobelli et al. (2022) that the implementation of blockchain provides a trust mechanism for the various partners within the circular ecosystem of the SC.

Secondly, concerning the direct relationship between BCT and SC transparency, the empirical data analysis further confirms that BCT significantly contributes to SC transparency. The integration of BCT facilitates seamless and secure information flow within the SC, enabling real-time access to shared data among key stakeholders, including suppliers, manufacturers and customers. This enhanced flow of information eliminated data silos, reduced discrepancies and ensured that all SC partners operated based on the same, accurate and immutable records. A major contributing factor to this increased transparency is BCT's decentralised ledger system, which ensures that all participating entities have access to an identical and synchronised version of transaction records. This would minimise the risks of information asymmetry, mitigate fraudulent activities and enhance traceability.

Thirdly, the results also confirmed the significant positive relationship between SC transparency and SC trust. This suggests that the greater the transparency within the SC, the stronger the trust among partners. When SC participants have clear visibility into transactions, operational processes and decision-making, they are more likely to engage in open communication and cooperative behaviour. As the study findings reinforce the idea that enhancing transparency led to a higher level of information sharing, hence reducing risks. By ensuring all SC partners have equal access to accurate, timely and verifiable information, SCM can be significantly enhanced, and BCT plays a crucial role in enabling such transparency.

Fourthly, the study findings support the notion that SC transparency serves as a partial mediator in the relationship between BCT and SC trust. This implies that BCR enhances transparency, which in turn contributes to higher levels of trust among SC partners. The observed medication effect suggests that while BCT directly influences trust, part of this change occurs through its effect on transparency. A possible explanation for this mediating role is that higher levels of transparency offered by BCT reduce information asymmetry and enhance visibility across the SC, thereby closing the trust gap between SC partners.

Conclusion and future recommendation

This research examined the effect of BCT on trust among SC partners, with a specific emphasis on the mediating role of SC transparency. To achieve this research aim, an exploratory research approach was adopted using a quantitative survey method. Data were collected from industry experts and professionals working in organisations operating in Egypt, leveraging convenience and snowball sampling techniques. The survey instrument was developed using validated measurement items from previous literature to ensure alignment with the research model. The data collection process was conducted online via Google Forms, primarily through professional networking platforms such as LinkedIn, ensuring voluntary participation and periodic follow-ups to maximise response rates.

The study findings reinforce the significant role of BCT in enhancing SC trust and transparency, confirming that SC transparency partially mediates the relationship between BCT and trust. Furthermore, this research also highlights that transparency alone may not fully account for trust-building within SC and that other BCT attributes such as immutability, traceability and smart contracts should be explored to maximise trust-enhancing effects.

This study advances current research by clarifying how BCT strengthens interorganisational trust through enhanced transparency mechanisms in SCs. Specifically, our findings propose that transparency serves as a mediating channel through which BCT transforms informational visibility into relational trust among SC partners. By emphasising the transparency-trust pathway, this study reconciles the contrasting views of BCT as a 'trustless' system versus a 'trust reinforcing' mechanism.

These research insights contribute to both academia and practice, leading to future research on BCT-driven trust mechanisms in SC ecosystems. For SC managers and professionals, this research provides insightful information regarding the strategic implementation of BCT solutions to enhance trust and collaboration between SC partners. Furthermore, this research is recommending organisations prioritise transparency-enhancing features such as real-time tracking, decentralised ledgers and open data exchange to build trust among SC partners. And since transparency has only a partial mediating effect, organisations should explore additional BCT features, including immutability, traceability and security, to further strengthen SC trust. Finally, this research is highly recommending that organisations should regularly assess BCT implementation outcomes to adjust strategies and enhance trust-building capabilities over time.

This research provides practical value to multiple stakeholders, with SC professionals and organisations as the primary beneficiaries. This research can assist in understanding how BCT can promote transparency and trust among SC partners. The findings help managers in emerging

economies evaluate the perceived potential of BCT. Furthermore, researchers and policymakers can leverage the findings to guide future investigations and technology diffusion initiatives across emerging markets.

Theoretically, this research contributes to SCM research by offering empirical evidence on how BCT influences SC trust through transparency. Additionally, this research advances our understanding of BCT's mechanisms for building trust, particularly in emerging economies such as Egypt. Additionally, this research offers an expansion to existing literature by confirming the partial mediation role of SC transparency. Finally, this research strengthens theoretical foundations through real-world survey data, reinforcing the empirical validity of BCT's effect on trust and transparency.

In conclusion, while this study has provided valuable insights into the effect of BCT on trust within SC, it is important to acknowledge the limitations inherent in the research design. By considering these limitations and implementing the recommended recommendations, future researchers can build upon this foundation and contribute to a deeper understanding of the complex relationship between BCT, transparency and trust in SC.

The first limitation is that, while SC transparency remains important, it may not be the sole driver of SC trust when BCT is employed. Alternative mechanisms, such as the immutability and security features of blockchain, as well as the implementation of smart contracts, should be duly considered, which might be a promising area for future research directions (Hatem & Zayed 2024).

Furthermore, it is important to acknowledge the limited sample size of this study, as well as the specific context of the study, which focused mainly on Egypt. The cultural, economic and regulatory factors in Egypt may differ from other regions, affecting the outcomes. Accordingly, future researchers should aim to replicate this study in different contexts to validate the findings and enhance the external validity of the research, which may impact the generalisability of the findings.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

CRediT authorship contribution

Esraa O. Zayed: Conceptualisation, methodology, formal analysis, writing – original draft, visualisation, project administration, software, validation, resources, writing – review & editing. Marwan Hatem: Methodology, formal analysis, investigation, writing – original draft, visualisation, resources, writing – review & editing, supervision. All authors reviewed the article, contributed to the discussion of results, approved the final version for submission and publication and take responsibility for the integrity of its findings.

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Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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