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Exploring Blockchain Adoption Drivers in Manufacturing Supply Chains: An Integrated TAM-TTF Perspective

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ABSTRACT

Technological innovation has brought significant improvement in both productivity and sustainability of 21st-century organizations. Despite significant challenges in implementing blockchain in supply chain management (SCM) systems, blockchain provides sustainable benefits to companies in effectively managing supply chain operations. This study aims to explore the factors influencing the manufacturing organizations' blockchain adoption in their SCM. To accomplish the research objective, this study incorporates the integration of the TAM and TTF model. Using a questionnaire survey, necessary data have been solicited from 223 employees working in the SCM department of manufacturing companies. The Structural Equation Modelling method has been used to test the proposed hypotheses. Statistical findings outline the significance of TTF in molding users' perception regarding the benefits and simplicity of the particular technology. All constructs of the TTF model have a significant effect on TTF, which thereby impacts perceived usefulness (PU) and blockchain adoption (BCA). Perceived Ease of Use (PEOU) has a positive impact on PU, and PU has a substantial impact on BCA. But PEOU does not significantly impact BCA. The integration of TAM and TTF models in BCA enriches existing literature through theoretical advancement. In practice, this study contributes to organizations' policy development in improving system efficiency, security, and traceability through blockchain adoption.

KEYWORDS: Blockchain Adoption; Manufacturing; Supply Chain; TAM Model; TTF Model

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1. Introduction

Amid ongoing technological advancements, the competitiveness and efficiency of modern organizations are significantly influenced by the supply chain management (SCM) systems (Zhang, Gao, & Luqman, 2022). A well-integrated supply chain ensures the seamless flow of materials, goods, and information from suppliers to final consumers, enabling businesses to meet consumer needs effectively (Jiang et al., 2023). However, due to globalization, outsourcing, and multi-tiered supplier relationships in modern SCM are becoming increasingly complex. Such a complex SCM often results in dispersed information, slow communication, and a lack of coordination among supply chain stakeholders (Zhang, Gao, & Luqman, 2022). These issues lead to common SCM inefficiencies such as the bullwhip effect, inventory mismanagement, demand-supply mismatches, and planning interruptions. One of the primary causes of these inefficiencies is the imbalanced and distorted information flow across various supply chain tiers, which often results from manual interventions or non-integrated systems (Qiao & Zhao, 2023). Blockchain technology (BT) has evolved as a viable solution in this regard, and it offers a secure, transparent, and irreversible record of events and transactions (Jum'a et al., 2024). Therefore, blockchain ensures traceability, trust, and accountability in SCM operations by facilitating the real-time sharing and verification of data across supply chain players.

BT is a distributed and decentralized ledger system that securely and impenetrably records, validates, and disseminates data and transactions across a network. Although blockchain technology was initially introduced to support cryptocurrencies, it is now being applied in diverse sectors. Due to its transparency and immutability, digital records have been widely utilized in various industries, including government (Rupa & Sultana, 2024), healthcare, finance, education (Rupa et al., 2025; Zhao et al., 2023), and logistics (Aslam et al., 2024). BT has emerged as a game-changing technology as it eliminates middlemen, lowers fraud, and automates processes using smart contracts. Similarly, blockchain improves transparency and coordination in SCM (Qiao & Zhao, 2023). All supply chain stakeholders, comprising suppliers, manufacturers, logistics companies, distributors, and retailers, had real-time access to a single, validated version of data.

Manufacturing companies often operate in complex environments with multiple suppliers and other trading partners, complex supply chain operations, and diversified regulatory standards. In this respect, blockchain facilitates enhancing product quality, maintaining compliance with various standards, and mitigating the risks of obsolete parts and components (Jiang et al., 2023). Moreover, it improves product quality by gathering and sharing real-time information with supply chain partners at different stages of production and distribution processes. Furthermore, manufacturers can augment responsiveness to demand fluctuations, streamline inventory management, and supply chain visibility by incorporating other digital technologies into blockchain (Hrouga, Sbihi, & Chavallard, 2022). As a result, blockchain improves operational efficiency and customer satisfaction in the long run. Conventionally, information sharing within supply chain partners was managed through centralized systems. These systems, however, were often exposed to security threats such as data breaches, data manipulation, and inconsistencies. The emergence of blockchain in SCM has addressed these vulnerabilities. Through transparent and trustworthy data sharing among the supply chain stakeholders, blockchain supports better collaboration and contributes to improved efficiency and performance.

The manufacturing industry in Bangladesh makes a significant contribution to Gross Domestic Product (GDP), and this sector is growing at an increasing rate. In 2021 manufacturing industry contributed 22.47% of total GDP (Manik, 2023). Moreover, 90% of the country's aggregate export earnings come from the manufacturing industry (Islam et al., 2024). The Ready-Made Garments

(RMG) sector alone yielded $38.48 billion export earnings in 2024 (Hasan, 2025). Therefore, the operational efficiency of the supply chain of the manufacturing industry has a positive impact on GDP and the economic growth of Bangladesh. However, the supply chains of these export-dependent sectors widely use blockchain for traceability and efficient information sharing across the chain. Literature also emphasizes using blockchain in SCM for food safety and halal compliance in the food industry (Adhiwibowo, Widayat, & Syafei, 2025), for reduced waste, transparency, and cost-efficiency in RMG companies (Niloy et al., 2024), underscoring the significance of blockchain in manufacturing SCM. Therefore, studying the factors influencing the integration of blockchain in manufacturing SCM is contemporary for Bangladesh.

However, despite having enormous benefits of integrating blockchain in SCM, its adoption, particularly in manufacturing companies, is limited. Different implementation challenges, such as organizational, technological, and environmental, impede its widespread adoption (Saif et al., 2022), underscoring the significance of studying factors that affect BT adoption in SCM. The increasing global interest in blockchain applications across diverse sectors highlights a notable gap in comprehending the factors that affect its adoption in manufacturing supply chains, mainly in developing economies such as Bangladesh. Research in emerging economies has been constrained, frequently neglecting context-specific barriers including inadequate technological infrastructure, insufficient awareness, and managerial resistance (Gökalp, Gökalp, & Çoban, 2022).

Existing research predominantly emphasizes examining blockchain's technical capabilities and advantages, as well as implementation challenges (Saif et al., 2022; Yadav et al., 2024). Few studies on BT adoption are based on the supply chain in the agricultural industry (Saurabh & Dey, 2021; Sharma et al., 2023), the Small and Medium Enterprises (SME) industry (Kumar Bhardwaj, Garg, & Gajpal, 2021), the automobile industry (Chen, Abdul-Hamid, & Zailani, 2024), the aviation industry (Li et al., 2021), and the real estate sector (Alazab et al., 2021), neglecting the context of manufacturing companies. Furthermore, although the "Technology Acceptance Model" (TAM) is frequently employed to elucidate technology adoption (Jum'a et al., 2024; Kumar Bhardwaj, Garg, & Gajpal, 2021; Chen, Abdul-Hamid, & Zailani, 2024), there is a scarcity of research that combines TAM with the "Task-Technology Fit" (TTF) model to assess the alignment of blockchain with particular operational tasks within the manufacturing supply chain. This integration is essential, as it recognizes that perceived usefulness alone may not facilitate adoption unless the technology aligns effectively with the user's tasks and needs. In the context of Bangladesh, an economy pursuing industrial digitization under "Vision 2041," there is a critical requirement for empirical evidence regarding the factors that facilitate or impede blockchain adoption (BCA) within the local manufacturing sector. Therefore, this study aims to investigate the factors driving BT adoption in the manufacturing supply chain in emerging economies like Bangladesh. The subsequent research questions are as follows:

RQ1: What factors influence blockchain adoption in the supply chain of manufacturing companies in Bangladesh?

RQ2: Does task-technology fit influence users perceived usefulness?

The following parts of this work are set up as follows. Part 2 discusses both the literature review and the theoretical basis. Section 3 describes the methods used, and Section 4 illustrates the outcomes, which are then discussed in Section 5. Section 6 sheds light on what the results mean in theory and in practice in the form of implications. In the end, Section 7 gives an understanding of the limitations and future research directions, including closing remarks.

2. Literature review

2.1 Manufacturing supply chain

The manufacturing supply chain is a complex network of actions and processes. Although the supply chain network is dispersed, it acts cohesively. Raw materials and manufacturing items acquisition, inventory monitoring, goods transportation, and final products deliveries are the major operations of manufacturing supply chains. Business organizations must guarantee prompt deliveries and competitive pricing (Wong et al., 2024; Hlioui, Gharbi, & Hajji, 2015). The growing interest in incorporating digital technologies, particularly blockchain, into supply chains stems from its ability to enhance trust, transparency, and traceability among stakeholders. The supply chain is influenced by the "perceived ease of use" (PEOU) and "perceived usefulness" (PU) of blockchain, which dictate its level of adoption among users. The efficacy of technology in specific supply chain roles, such as recording and validating transactions, is contingent upon the integration of its features, including immutability, decentralization, and smart contracts, with those responsibilities. To comprehend the factors that facilitate or hinder the adoption of blockchain in business, one must understand the operational dynamics of the industrial supply chain.

2.2 Theoretical framework

Grounded on the theory of TAM and TTF models, this study incorporates these two models. When combined, these two frameworks provide a strong basis for comprehending the contextual and behavioural issues that promote BCA in the supply chain of manufacturing corporations. The TAM model highlights that PU and PEOU drive a person’s technology use intention. For this study, blockchain is the designated technology. Hence, for this context, PU is the supply chain experts’ perception in enhancing their performance in the form of increased security, speed, and transparency. Another variable of TAM, denoted as PEOU, emphasizes the efforts required to learn and manage BT for SCM. This model has been selected and modified for this study, following the previous studies (Cao, Guo, & Li, 2025; Chen, 2023; Shrestha et al., 2021). TAM is considered suitable for this study because of its simplicity and effectiveness in predicting technology use (Venkatesh & Davis, 2000).

The TTF model was introduced by Goodhue and Thompson (1995), who improved the TAM model by connecting technological features to the user-specific task of that technology. Dishaw & Strong (1990) highlighted that a good fit of technology with the task requirements of the users is a significant driver of users’ technology adoption. Immutability, decentralization, and smart contracts are considered the major features of blockchain (Saberi et al., 2019). The characteristics of blockchain facilitate organizations in real-time tracking of goods, keeping supply chain transactions secure, and coordinating among the trading partners of the supply chain. Hence, the TTF model provides an understanding of how blockchain can mitigate the traditional problems in manufacturing supply chains.

The TAM and TTF models have been amalgamated to forecast the influence of task-technology alignment and individual cognitive perceptions on BCA. Research conducted by Dishaw & Strong (1999) and Zhou, Lu, & Wang (2010) highlights that the integration of these models provides a more thorough understanding of adoption behaviour than any single model can explain independently. TTF evaluates whether blockchain is good for the job, while TAM examines whether people will use blockchain. However, blockchain technology is a complicated system that relies on certain tasks in an industrial supply chain. Therefore, the use of this integrated framework is suitable in this context to understand the organizations' blockchain adoption perception.

2.3 Hypothesis Development

2.3.1 Perceived Usefulness (PU)

PU is described as users' perception that use of a certain technology will boost their work performance (Davis, 1989). Blockchain's perceived value in manufacturing supply chains stems from its capacity to improve traceability, data integrity, and transparency across complex networks (Yang et al., 2025). Users are more inclined to use blockchain if they perceive it will increase operational effectiveness, lower fraud, or improve decision-making, accentuating the significance of PU in influencing adoption decisions (Yang et al., 2025). Literature has discovered that PU has a significant impact on blockchain adoption in SCM (Kurrotaa'yun et al., 2025; Kumar Bhardwaj, Garg, and Gajpal, 2021; Chengyue et al., 2021). Hence, the below hypothesis is posited:

H1: PU positively influences BCA in the manufacturing supply chain.

2.3.2 Perceived Ease of Use (PEOU)

PEOU is the users' expectation that the given technology will be easy and simple to use (Davis, 1989). The complexity of blockchain systems, with cryptographic functions and distributed ledgers, might deter adoption unless they are easy to use (Alazab et al., 2021). A high PEOU level reduces apprehension and resistance to using the system. Kurrotaa'yun et al. (2025) found that PEOU has a substantial impact on the intention to use digital technologies, such as blockchain, in business settings. However, Kumar Bhardwaj, Garg, and Gajpal (2021) did not support this association.

People are more likely to recognise a technology or application as effective when they can use it efficiently (Sciarelli et al., 2022). The TAM model relies on this causal path as one of its core principles. Users can make better decisions and maintain productivity with blockchain platforms that have intuitive interfaces and require minimal training in manufacturing supply chains (Sciarelli et al., 2022). Venkatesh and Davis (2000) also emphasised PEOU's foundational role in moulding users' perceptions of technology utility. Moreover, Kurrotaa'yun et al. (2025) found that PEOU has a positive impact on PU. Thus, the following hypotheses are proposed:

H2: PEOU positively influences BCA in the manufacturing supply chain.

H3: PEOU positively influences PU in the manufacturing supply chain.

2.3.3 Task Characteristics (TC)

The extent to which technology facilitates work processes is widely dependent on task requirements (Goodhue & Thompson, 1995). Perceived TTF in digital settings is enhanced by tasks that are clearly defined (Seneviratne et al., 2022). TC in this context refer to the specific needs of supply chain operations, including the necessity of secure data sharing, real-time tracking, partner coordination, and regulatory compliance (Yang et al., 2025). Accuracy, responsibility, and prompt information sharing are necessary for these tasks, particularly in globally dispersed manufacturing systems. Alazab et al. (2021) found a positive influence of TC on TTF in the supply chain context. Blockchain can meet these needs, and a more precise assessment of fit is possible with well-defined task characteristics. Thus, the hypothesis is proposed as below:

H4: TC positively influences TTF in the manufacturing supply chain.

2.3.4 Technology Characteristics (THC)

The operational functionalities that aid users in accomplishing their activities are known as the THC in TTF model (Goodhue & Thompson, 1995). For this study, the technological functionalities are decentralisation, transparency, traceability, irreversibility, and execution of designated tasks through smart contracts (Yang et al., 2025). These features enable SCM to address major supply chain challenges, e.g., preventing fraud, maintaining regulatory compliance. If BT capabilities correspond with operational rudiments, users perceive a good task technology fit (Alazab et al., 2021). The benefits of BT for SCM operations enhance practitioners' perceptions regarding TTF. Hence, the subsequent hypothesis is posited:

H5: THC positively influences TTF in the manufacturing supply chain.

2.3.5 Task-Technology Fit (TTF)

The term "task-technology fit" (TTF) refers to the extent to which a technology effectively meets the needs of its users (Goodhue &Thompson, 1995). The higher the alignment between these task demands and blockchain features enhances user performance and increases the adoption possibility. In this study context, smart contracts facilitate automated coordination and transaction execution, while the blockchain's immutable ledger is well-suited to meet traceability requirements. Organisations are more likely to embrace and successfully apply blockchain when its features are thought to sufficiently support the operational tasks of the manufacturing supply chain (Saberi et al., 2019). A good task-technology fit results in reducing uncertainty, justifying investment, and increasing confidence in successful deployment. (Dishaw & Strong, 1999) highlighted that TTF positively impacts both adoption intention and the actual use of IT solutions. Similar outcomes were presented by Wang et al. (2021) in a blockchain-related setting, with an emphasis on how a high TTF promotes quicker and more widespread adoption in complex supply chains. Moreover, to improve task outcomes in supply chain operations, TTF shapes the perception that blockchain improves PU (Alazab et al., 2021). There will be a strong fit between the technology and the task at hand if the user considers blockchain as helpful and practical. Zhou et al. (2010) also established a positive correlation between TTF and PU (Alazab et al., 2021; Yang et al., 2025).

H6: TTF positively influences BCA in the manufacturing supply chain.

H7: TTF positively influences PU in the manufacturing supply chain.

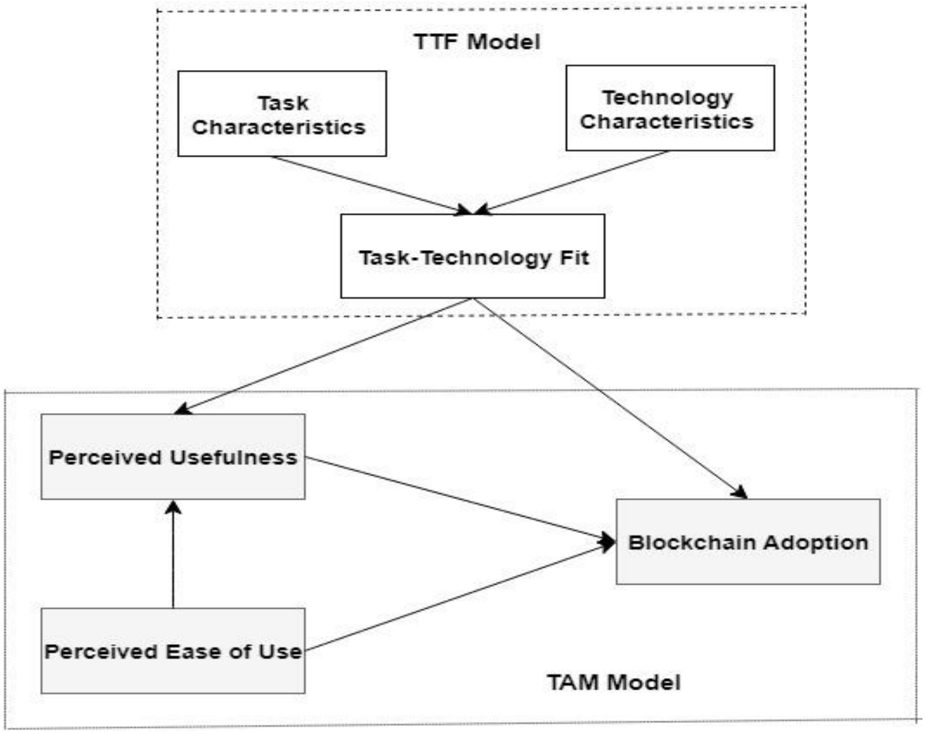

Figure 1: Conceptual framework

3. Methodology

3.1 Research approach

To gather data from a large sample and produce statistically significant results, both academic and industrial research have historically acknowledged and employed a quantitative research design, notably the survey questionnaire method. The survey questionnaire method is particularly effective for standardizing the assessment of attitudes, perceptions, and behaviours, thereby facilitating the generalizability of findings (Venkatesh, Thong, & Xu, 2012). Studies on technology adoption (Chen, Abdul-Hamid, & Zailani, 2024; Nayak et al., 2025) illustrate that it allows scholars to quantify relationships between variables and empirically test hypotheses.

3.2 Data collection instrument and measurement scales

A questionnaire comprising the items that make up the constructs has been developed to carry out this study. The first section of the questionnaire includes only the respondent's position and the firm's age. Using a Likert scale with 1 = "strongly disagree" and 5 = "strongly agree," the second segment has 21 items designed to gauge acceptability of the study constructs (Matas, 2018).

This study utilizes measurement scales developed based on prior studies. The studies demonstrated validity and reliability exceeding 0.70, as shown in Table 1 (Hair et al., 2019). The study includes several constructs, each defined by a specific number of items derived from prominent academic sources. The measurements of the constructs are shown in Appendix A.

3.3 Population, sampling method, and data collection

The study focused on supply chain stakeholders, particularly managers and employees working in the supply chain or logistics of manufacturing companies in Bangladesh, e.g., food and beverage companies, RMG companies, and pharmaceutical companies. The study must investigate stakeholder perceptions regarding the implementation of blockchain technologies within manufacturing SCM systems in Bangladesh. Therefore, this study adopted purposive sampling. The questionnaire was prepared using Google Forms and disseminated to the target respondents through social media platforms, specifically WhatsApp, LinkedIn, and Email. In the beginning, the questionnaire was sent to 270 respondents, and only 227 valid and complete replies were received, resulting in an adequate sample size of 84%. Every step of the study was conducted by ethical guidelines, ensuring that participant data was treated with care to preserve their privacy (Denzin & Lincoln, 2011). Prior consent was obtained from the respondents, and their participation was completely voluntary.

3.4 Data analysis, model complexity, and sample size determination

"Partial least squares structural equation modelling" (PLS-SEM) was selected for its flexibility, particularly in behavioural studies (Chen, Abdul-Hamid, & Zailani, 2024; Alazab et al., 2021). The integrated TAM-TTF model has been operationalized as a multi-layer SEM framework (Li & Liang, 2025). Every construct of the model is modeled reflectively using multiple indicators. Initially, TC and THC contracts affect TTF, which then impacts TAM constructs and BCA. The hierarchical SEM structure simultaneously estimates the measurement and structural relationships across both models. Besides, PLS-SEM is useful for research studies having complex models as this method converges the presence of several latent variables. Hence, PLS-SEM provides better outcomes in model convergence. Moreover, this method is widely applicable for theory exploration rather than confirmation (Hair et al., 2019). Furthermore, this method fits well when the sample size is small. Therefore, PLS-SEM is an appropriate selection for this study. And this study used SMARTPLS version 4.0.9.9 for analysis.

Various guidelines are applied to determine the sample size for PLS-SEM. Hair et al. (2010) suggest that the sample size should exceed 10 times the total number of items used. For this study, 21 items have been used. Therefore, a minimum of 210 samples is deemed enough for the study. Moreover, according to Kline (2023), 200 sample size is considered adequate for SEM analysis. For this study, 227 valid responses have been used, which surpasses the minimum sample size requirement.

4. Analysis

The proposed research model was evaluated using the PLS algorithm. The maximum number of iterations was set to 5000. The following sessions demonstrate and interpret the results of the model.

4.1 Measurement model

In this model, "Factor Loadings" (FL), "Cronbach's Alpha" (CA), "Composite Reliability" (CR), and "Average Variance Extracted" (AVE) are standard metrics for assessing reliability and convergent validity. A model is deemed acceptable for internal consistency when FL, CA, and CR values exceed 0.7. Table 1 presents that all values for FL exceed 0.711, indicating acceptable individual item reliability (Hair et al., 2019). The construct reliability and internal consistency are confirmed as the values for CA and CR are greater than 0.70 (Hair et al., 2019). Moreover, AVE values for all variables were measured to ensure convergent validity and found to be higher than 0.50, confirming convergent validity (Sarstedt, Ringle, & Hair, 2021).

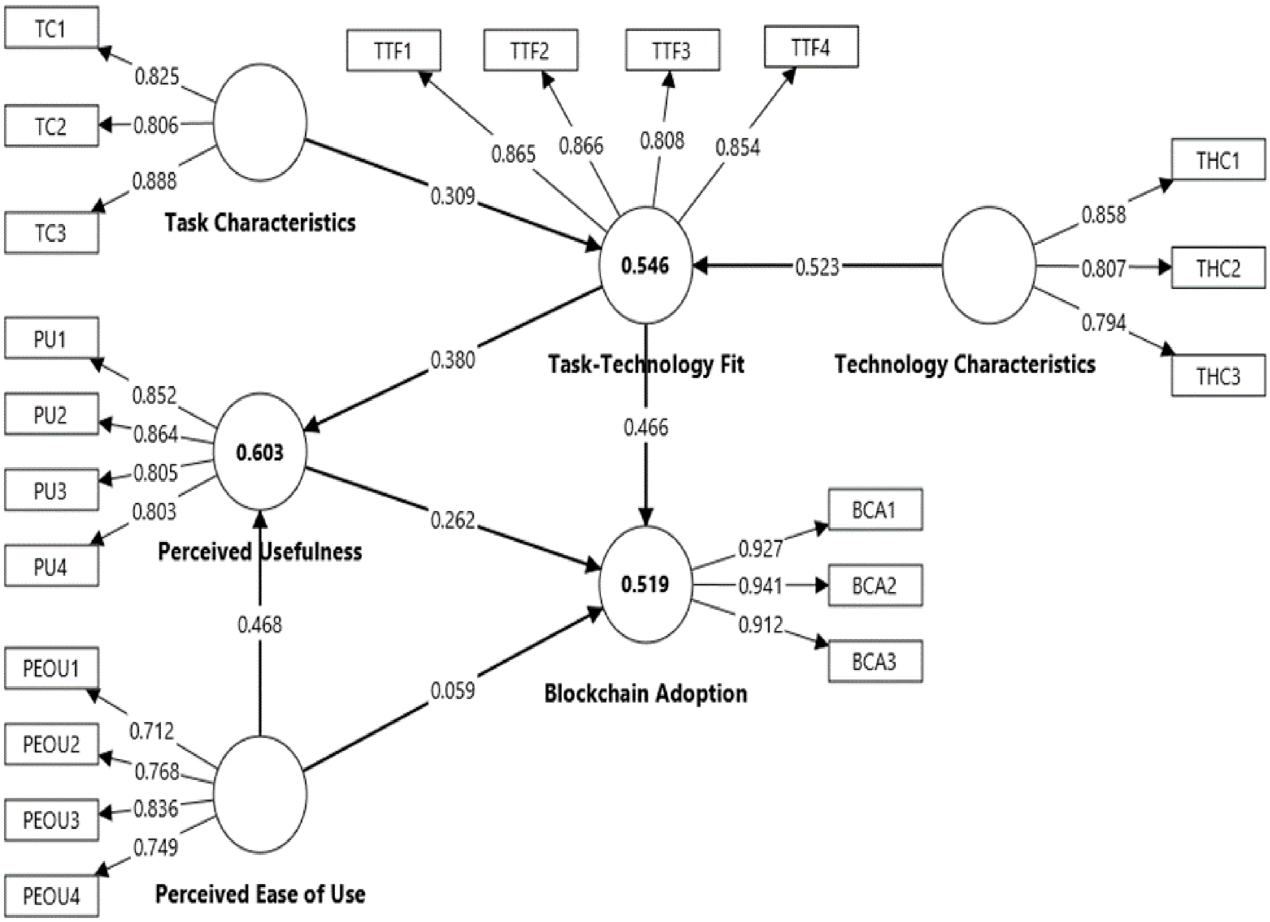

Figure 2: Path model of the study

Table 1: Measurement model

Constructs	Items	Loadings	CA	CR	AVE
PU	PU1	0.852	0.851	0.899	0.691
	PU2	0.864			
	PU3	0.805			
	PU4	0.803			
PEOU	PEOU1	0.712	0.773	0.851	0.589
	PEOU2	0.768			
	PEOU3	0.836			
	PEOU4	0.749			
TC	TC1	0.825	0.791	0.878	0.706
	TC2	0.806			
	TC3	0.888			
THC	THC1	0.858	0.756	0.860	0.672

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	THC2	0.807			
	THC3	0.794			
TTF	TTF1	0.865	0.870	0.911	0.720
	TTF2	0.866			
	TTF3	0.808			
	TTF4	0.854			
BCA	BCA1	0.927	0.918	0.948	0.859
	BCA2	0.941			
	BCA3	0.912			

To apprehend the evaluation of divergent validity, the Heterotrait-monotrait (HTMT) ratio is evaluated. For this study, all the HTMT values, as presented in Table 2, are well below 0.90; therefore, they establish the divergent validity of the model (Sarstedt, Ringle, & Hair, 2021).

Table 2: Heterotrait-Monotrait (HTMT) Ratio

	BCA	PEOU	PU	TC	TTF	THC
BCA						
PEOU	0.644					
PU	0.708	0.849				
TC	0.758	0.680	0.750			
TTF	0.768	0.793	0.805	0.709		
THC	0.697	0.843	0.738	0.698	0.848	

4.2 Structural Model

The structural model evaluates the ability of the proposed pathways to designate the relationships between the latent constructs accurately. The model fitness data has been demonstrated in Figure 3. The SRMR value and NFI values for both models are well below the recommended value of 0.08 for SRMR (Henseler et al., 2016) and 0.90 for NFI (Hu & Bentler, 1999), respectively. Therefore, it is assured that there is a good fit between the data and the model. Table 3 displays the results of the structural model. As shown in Figure 2, the model demonstrates 60% variance in perceived usefulness, 54% variance in task-technology fit, and 51% variance in blockchain adoption, indicating a good fit for the model (Sarstedt, Ringle, & Hair, 2021).

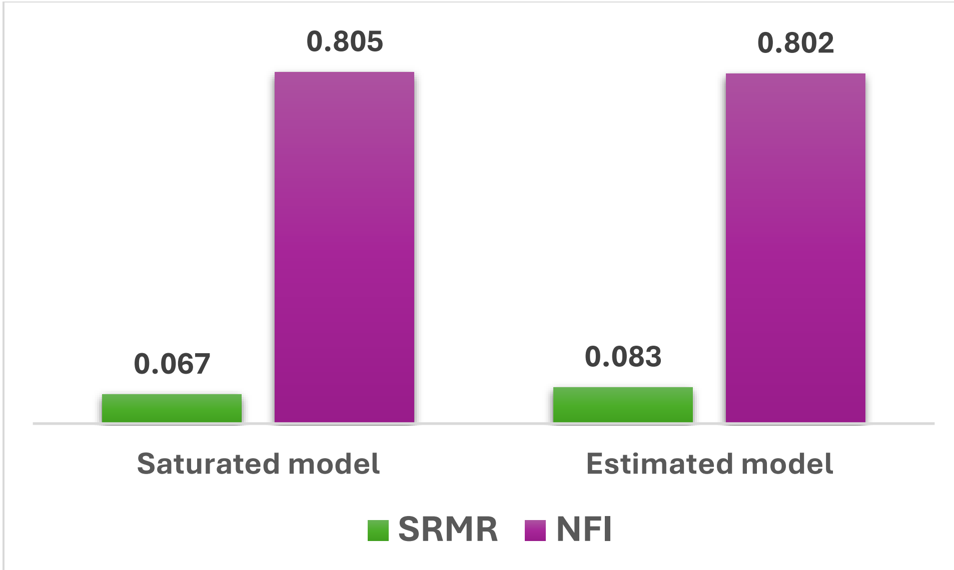

Figure 3: Fitness indices

Using the bootstrapping technique, the structural model evaluates the hypotheses, which depict that all hypotheses except H2 are accepted, as presented in Table 3. It is demonstrated that PU (t = 3.145, p = 0.002) and TTF (t = 5.013, p = 0.000) have a significant impact on BCA, accepting hypotheses H1 and H6. Additionally, PEOU (t = 7.144, p < 0.001) and TTF (t = 5.013, p < 0.001) are found to have a significantly positive impact on PU. Hence, H3 and H7 are supported. Two variables of the TTF model, e.g., TC (t = 4.982, p < 0.001) and THC (t = 8.506, p < 0.001), have a positive impact on TTF, supporting H4 and H5. However, PEOU does not exhibit a significant influence on BCA.

The current study model lacks multicollinearity because every "Variance Inflation Factor" (VIF) value is less than 5. With an effect size of 0.425, Table 3 demonstrates a significant effect of THC, while the others have medium effects, as all other values for f2 are less than 0.35 but greater than 0.15 (Cohen, 1988).

Table 3: Structural model assessment for direct connections

Hypotheses	Relations	Std Error	T values	P values	f^2	VIF	Decision
H1	PU -> BCA	0.083	3.145	0.002	0.167	2.522	Supported
H2	PEOU-> BCA	0.068	0.863	0.388	0.003	2.390	Not Supported
H3	PEOU-> PU	0.066	7.144	0.000	0.301	1.838	Supported
H4	TC-> TTF	0.062	4.982	0.000	0.179	1.420	Supported
H5	THC-> TTF	0.062	8.506	0.000	0.425	1.420	Supported
H6	TTF-> BCA	0.065	8.699	0.000	0.343	1.838	Supported
H7	TTF-> PU	0.075	5.013	0.000	0.196	1.838	Supported

5. Discussion

This research explores the key drivers of adopting blockchain in SCM by the manufacturing firms. This study examines the determinants of blockchain adoption among manufacturing companies in the SCM context. There is a scarcity of literature on blockchain and supply chain integration using IT adoption models. Thus, this study integrates the TAM and TTF models and uses a cross-sectional Bangladeshi sample to predict blockchain adoption intention.

Findings show that PU positively impacts BCA, supporting the results in the literature (Yang et al., 2025; Kurrotaa'yun et al., 2025; Kumar Bhardwaj, Garg, & Gajpal, 2021; Chengyue et al., 2021). The likelihood of users adopting blockchain will increase when they perceive it as enhancing their task performance, aligning with the core assumption of the TAM model (Venkatesh & Davis, 2000). However, PEOU does not significantly influence BCA, corroborating the findings of Kumar Bhardwaj, Garg, &Gajpal (2021. The finding is contradictory to the conclusions drawn by the study of Kurrotaa'yun et al. (2025). This outcome of the study underscores that PEOU is not a pivotal predictor of blockchain technology. On the other hand, PEOU positively influences PU, aligning the premise provided by the TAM model (Venkatesh & Davis, 2000) and the results of Kurrotaa'yun et al. (2025).

THE and TC both have a positive effect on TTF. The results are consistent with prior results (Alazab et al., 2021) and the TTF model (Goodhue & Thompson, 1995). Such findings signify that the users' perceptions of fit are profoundly affected by the functional capabilities of blockchain technology and the nature of the jobs they do. In manufacturing settings, precision, transparency, and collaboration are important aspects for the supply chain. Hence, blockchain technology's traceability capabilities work well with operational duties of the supply chain of the manufacturing firms (Saberi et al., 2019).

Moreover, TTF has a strong positive effect on blockchain adoption, supporting the findings of earlier research by Alazab et al. (2021), Choi et al. (2020), and Dishaw and Strong (1999), who highlighted that business firms are more likely to adopt technologies that exhibit high task alignment. This finding suggests that users' intention to adopt increases significantly when they believe that blockchain capabilities align well with their job requirements (Thiruchelvam et al., 2018). Furthermore, TTF is found to have a significant effect on PU, supporting the findings in the literature (Alazab et al., 2021; Yang et al., 2025). This finding highlights that users consider a technology more useful when it effectively supports their job-related activities. Due to this task-technology congruence, people are more likely to believe that blockchain will improve their work, which increases PU.

Overall, the findings support the effectiveness of the integrated TAM-TTF framework in explaining blockchain adoption within the context of manufacturing supply chains. The insignificant direct influence of ease of use indicates that, if perceived benefits and task alignment are sufficiently strong, technological complexity may be tolerated, even though usefulness and task alignment emerged as the main drivers of adoption. This observation is especially pertinent in developing nations, where technological choices are frequently made based more on results than usability.

6. Implications

6.1 Theoretical implications

This study offers several theoretical contributions to the literature. First, this study enhances the existing body of knowledge on blockchain through the integration of TAM and the TTF models. As a result, this study captures the influence of individual perceptions and technology and task alignment on adoption behaviour within manufacturing companies (Goodhue & Thompson, 1995; Davis, 1989). Moreover, this study combines the benefits of integrating both frameworks and provides a more comprehensive understanding of adoption behaviour in technology-driven sectors. Therefore, this integrated approach to blockchain adoption in the manufacturing firms fills a gap in empirical research, which has largely been either conceptual or exploratory in nature (Chang, Chen, & Lu, 2019; Kouhizadeh, Saberi, & Sarkis, 2021.

Second, this study provides empirical insights for the developing nations, particularly in the context of South Asian countries. As a result, it addresses a significant contextual gap in the technology adoption literature. Besides, it offers a focused examination of the dynamics of blockchain adoption within the manufacturing supply chain, which is a frequently neglected area in supply chain literature (Alazab et al., 2021; Yang et al., 2025). Therefore, sector-specific data can facilitate the development and execution of digital transformation policies for industries in Bangladesh and other emerging countries.

6.2 Practical implications

The findings of this study provide various practical insights for the managers, policymakers, and developers within the manufacturing companies of Bangladesh. This study identifies the key drivers, e.g., PU, PEOU, and TTF, of blockchain adoption for manufacturing companies. Managers of these companies could emphasize these aspects to accelerate the adoption of this technology for enhanced performance. Moreover, they must ensure the compatibility of the technology with their core tasks and arrange proper training for the employees to improve user PEOU and PU. Even organizations could focus on awareness development programs for the employees on the potential benefits of blockchain. Furthermore, suitable training programs are essential, highlighting the importance of training and technical skill enhancement in overcoming employee resistance to blockchain adoption. The results can also help technology providers and consultants make blockchain solutions that fit the specific needs of manufacturing companies, which will make it more likely that the solutions will work. Second, blockchain designers should be careful about the potential compatibility of the technology with the company's supply chain operations and the user-friendliness of the technology. Therefore, this study guides the blockchain designers in developing useful tools for manufacturing companies.

7. Conclusion

This study seeks to explore the drivers affecting blockchain adoption in the supply chain context among manufacturing firms, employing an integrated framework based on the TAM and the TTF models. This model is subsequently evaluated using PLS-SEM, which assesses both measurement and structural components of the research framework. For this study, primary data were collected from respondents working in manufacturing companies in Bangladesh. Empirical results show that the TTF model constructs ensure the alignment of task and technology, which has a positive impact on both PU and blockchain adoption in SCM. TAM, PU, and PEOU also have a significant effect on BCA in the supply chain, while PEOU influences PU among users. The study enriches blockchain adoption literature by integrating TTF and TAM to explain the joint influence of task-technology alignment and user perceptions. To practice, the study accentuates the significance of task-aligned solutions and user-focused training, based on perceived utility, ease of use, and task-technology fit, providing valuable insights for enhancing blockchain adoption in Bangladesh's industrial sector.

8. Limitations and future research directions

Although this study has significant contributions to the literature and policy, it presents several limitations that future studies could address. First, this study utilizes a cross-sectional approach to gather data on the perceptions of the respondents at a specific point in time. As a result, monitoring temporal fluctuations in adoption behaviour was not possible, calling for future studies to utilize longitudinal methodologies to observe the alterations in adoption behaviour among users (Podsakoff et al., 2003). Second, this study focuses only on manufacturing firms in Bangladesh, potentially constraining its applicability and generalizability to other settings. Hence, future research should encompass more industries and domains to assess the model's relevance in other contexts. Third, although the sample size for this study is statistically sufficient, the respondents are mainly from three major categories of manufacturing companies, e.g., food and beverage companies, RMG companies, and pharmaceutical companies. Therefore, it might be a good representation of the variety of manufacturing companies in business. Future studies may include stratified sampling to gather data from all kinds of manufacturing companies operating in Bangladesh to generalize the findings (Haird et al., 2019). Moreover, other external factors, for instance, regulatory support, technological infrastructure, and organizational readiness, may impact blockchain adoption. These factors could be examined in future models and studies (Ifinedo, 2011). Finally, standard method bias may be present due to the use of a single data collection method. Therefore, further studies can be conducted incorporating a mixed-method approach to reduce the potential bias (Podsakoff et al., 2003).

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Conflicts of Interest

The authors declare no conflict of interest.

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Appendix A

Variables	Items	Source
Task Characteristics (TC)	TC1: Supply chain operation requires inter-organizational coordination. TC2: Supply chain requires timely and accurate information. TC3: Supply chain operations require real time tracking of goods and information.	Tam, & Oliveira (2016); Goodhue, & Thompson (1995)
Technology Characteristics (THC)	THC1: Blockchain provides real-time traceability of goods and information. THC2: Blockchain provides coordination among supply chain partners. THC3: Blockchain provides timely and accurate information sharing.	Tam, & Oliveira (2016); Goodhue, & Thompson (1995)
Task Technology Fit (TTF)	TTF1: Blockchain use for supply chain is appropriate. TTF2: Using blockchain improves accuracy and efficiency in supply chain operations. TTF3: There is a good fit between supply chain needs and blockchain functionalities. TTF4: In general, blockchain is enough for supply chain operation management.	Tam, & Oliveira (2016); Goodhue, & Thompson (1995)
Perceived Usefulness (PU)	PU1: Blockchain increases supply chain performance. PU2: Blockchain boosts supply chain productivity. PU3: Blockchain improves supply chain efficiency. PU4: Blockchain is easy to understand and use for the manpower of my company.	Bhardwaj, Garg & Gajpal (2021); Chen, Abdul-Hamid, & Zailani, (2024)
Perceived Ease of Use (PEOU)	PEOU1: Blockchain is easy to use. PEOU2: The features of blockchain are clear and understandable. PEOU3: Blockchain offers a user-friendly alternative to traditional supply chain method. PEOU4: Blockchain is easy to interact with.	Bhardwaj, Garg & Gajpal (2021); Chen, Abdul-Hamid, & Zailani, (2024)
Blockchain Adoption (BCA)	BCA1: My company intends to adopt blockchain technology. BCA2: My firm intends to be among the pioneers in exploring Blockchain. BCA3: My firm intends to invest necessary resources in the blockchain-enabled supply chain.	Tan & Lee (2025); Zhang et al. (2023)