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Investigation of Factors Affecting the Adoption of Blockchain Technology in Supply Chain Management for International Trade Transactions

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ABSTRACT

The purpose of this study is to evaluate the factors influencing the adoption of blockchain technology in supply chain management for international trade transactions. The research employs a descriptive (survey-based) correlational method. The study population consisted of approximately 130 managers from manufacturing companies in the petrochemical industry, from which a sample of 97 individuals was selected as the final statistical sample based on the Krejcie and Morgan table. Convenience (non-probability) sampling was used. Data were collected through a designed questionnaire, which included items adapted from relative advantage, complexity, management support, cost, market dynamics, competitive pressure, regulatory policies, and behavioral intention (Wang et al., 2020), confidentiality and security (Queiroz & Wamba, 2019), and data integrity (Dutta et al., 2020). The questionnaire items demonstrated content validity (face validity) and high reliability (internal consistency and stability). Structural equation modeling was utilized to examine the relationships between the research variables using AMOS and SPSS software. The findings indicate that the relative advantage of the technology, technological complexity, confidentiality, data integrity, and data security do not have a direct relationship with the cost of adoption, management support, market dynamics, competitive pressure, or regulatory policies in blockchain technology within supply chain operations and management. However, technological complexity has a direct relationship with adoption costs, management support for technology implementation, and senior management support for blockchain technology in supply chain operations and management. The cost of technology adoption and technological complexity do not have an inverse relationship with the acceptance of this technology in supply chain operations and management.

KEYWORDS: Blockchain Technology, Supply Chain Management, International Trade Transactions

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1. Introduction

Blockchain technology is recognized as one of the most significant emerging technologies of the modern era, offering a decentralized and encrypted structure that enables the creation of new digital services and platforms (Ali et al., 2020). As a novel technology with immense potential, blockchain’s four distinctive features—traceability, trackability, transparency, and trust—can revolutionize material, information, financial flows, and transactions within and across organizations (Centobelli et al., 2021). The application of blockchain technology enhances efficiency and mitigates associated risks, thereby transforming the food supply chain. Although pilot studies have yielded positive feedback, this technology still requires further development and maturation. While its most prominent and widely discussed application is in digital cryptocurrencies, blockchain extends beyond financial domains to significantly impact international trade, taxation, supply chain management, operations, and commercial governance (Kimani et al., 2020). Blockchain technology has been endorsed as a viable solution for addressing persistent trust issues among trading partners in trade finance (Kowalski et al., 2021). It surpasses challenges associated with traditional transactions managed and regulated by trusted third parties (Upadhyay, 2020). It is posited that this technology has the potential to transform the world of commerce and the economic system (Pal et al., 2021). Blockchain offers the capacity to fundamentally reshape industries and services by providing new models for data storage, transparency, traceability, payment systems, and other advantages (Zutshi et al., 2021). The outcomes derived from these premises position blockchain as a technology with the potential to deliver significant benefits and innovations. However, its novelty has led to a lack of proper understanding and public trust (Alm et al., 2021). Despite the importance of such innovation, most published studies have focused solely on technical aspects. Given the lack of clear understanding regarding blockchain’s potential impacts on global market actors, the processes for its adoption and implementation remain ambiguous (Bawasano et al., 2020). Blockchain adoption by businesses has been met with skepticism by governmental institutions and policymakers due to its close association with Bitcoin, which has been tarnished by various frauds and scandals in the cryptocurrency market (Pal et al., 2021). Recent research indicates that blockchain can play a pivotal role in enhancing supply chain sustainability (Keshtri, 2021). By providing transparency, robustness, and the elimination of intermediaries, blockchain has gained significance in supply chain management (Budak & Kuban, 2021). With population growth and the expansion of supply networks, there is an increasing need for supply chains with enhanced capabilities. Products within these chains may be subject to undesirable changes, contamination, or fraud, making package traceability in the supply chain critical. The Internet of Things (IoT) and blockchain technology convert supply chain information into immutable blocks, thereby increasing transparency and efficiency.

Currently, much of the attention surrounding blockchain focuses on financial services, often overlooking non-financial service companies and the impact of blockchain on organizations, their business models, and the ways they create and deliver value (Morkunas et al., 2019). Blockchain promises to transform existing business models, make financial services more cost-effective, and contribute to better financial inclusion and even a more equitable distribution of economic wealth (Shinkus, 2020). However, this technology requires robust internet infrastructure, advanced hardware and software systems to receive, process, and exchange vast amounts of data, as well as innovative packaging methods and intelligent transportation networks. Despite existing challenges, blockchain enhances transparency, enables the identification of food product origins, reduces waste and environmental impacts, improves productivity, and enhances safety and quality. Many prominent global companies have successfully implemented pilot projects in this domain and are expanding their application to other products. In the near future, we can expect the widespread development of this technology across various countries.

This approach requires the support of large industries and significant investments to handle, process, and exchange vast amounts of data. Infrastructure challenges and lack of internet access in certain parts of the supply chain remain critical considerations (Gawolz et al., 2020).

2. Theoretical Foundations and Research Background

Hosseini et al. (2022) investigated the factors influencing sustainable supply chain management with a blockchain-based cognitive mapping approach. Their findings revealed that environmental performance enhancement, with a centrality degree of 6.844, had the highest impact, while transparency, with a centrality degree of 0.958, had the lowest. Additionally, environmental performance enhancement exhibited both the greatest influence and susceptibility. Based on these results, the researchers recommended that managers prioritize the emerging blockchain technology to enhance performance transparency, reduce costs, increase trust in transactions, and improve security. Ravaghi (2021), in a study titled "Package Traceability in the Supply Chain Based on IoT and Blockchain Technology," found that blockchain fundamentally provides a highly transparent operational environment. This offers numerous benefits, including reduced corruption, minimized waste, prevention of fraud and product tampering, verification of organic products and those with clear commercial origins, and recall of contaminated products. Farhzadi and Naser (2021), in their research titled "The Role of Blockchain Technology in Addressing Supply Chain Transaction Challenges: Requirements and Policy-Making," proposed blockchain implementation as a suitable solution to address existing supply chain management challenges. This is due to its transparency, mechanisms for preventing or resolving disputes online, and the elimination of financial intermediaries in electronic transactions. Asghari and Samiyari (2021), in a study titled "New Approaches in Supply Chain Management," identified supply chain challenges, including complex network connections, inventory management, distribution network design, distribution strategies, information flow, and financial transactions. Keshtri (2021), in a study titled "Blockchain and Sustainable Supply Chain Management in Developing Countries," demonstrated that blockchain, by increasing adoption in developing countries' supply chains, has the potential to enhance sustainability. For instance, blockchain can ensure compliance with regulations by monitoring production and distribution processes and provide consumers with accurate, verifiable product information to address sustainability concerns. This technology can also improve the quality of corporate environmental and social reporting. Blockchain-based traceability can be utilized to monitor and assess product quality, potentially reducing costs associated with recalls and waste. Matsuda et al. (2020) proposed a novel method for constructing a virtual supply chain as a multi-agent system, automatically generated by connecting software agents from selected organizational models in an electronic catalog. Wang et al. (2020), in a study titled "A Time for Digital Transformation: Blockchain Adoption in Operations and Supply Chain Management Among Malaysian SMEs," examined the effects of relative advantage, complexity, management support, cost, market dynamics, competitive pressure, and regulatory frameworks on blockchain adoption in operations and supply chain management among small and medium enterprises (SMEs) in Malaysia. The study covered technological (complexity and relative advantage), organizational (management support and cost), and environmental (market dynamics, competitive pressure, and regulations) dimensions. Empirical data from 194 SMEs were analyzed using a non-linear PLS-ANN method. Competitive pressure, complexity, cost, and relative advantage significantly influenced the inclination to adopt this technology, while market dynamics, regulatory support, and top management support were less significant predictors. SMEs often lack resources for technological investments but face similar requirements to streamline business processes for efficiency optimization. Blockchain, with its immutability, transparency, and security features, offers a viable option for SME sustainability. Kupito et al. (2020), in a study titled "Blockchain Technology Potentials in Supply Chain Management: Long-Term Judgments of an International Expert Panel," explored the disruptive impact of blockchain on supply chain operations. This empirical study, conducted through an interdisciplinary Delphi survey, systematically analyzed long-term judgments from a panel of 108 experts from academia, industry, policy, or associations with diverse backgrounds in blockchain, supply chain management, and hybrid functions. The results of forward-looking scenarios indicated how blockchain will be applied in supply chain management by 2035 and identified specific SCM barriers that must be addressed in advance. A key finding revealed that while blockchain enables transactions between untrusted parties, the trust-related benefits of blockchain are not directly transferable to SCM without additional conditions. The study suggests that blockchain will be robustly implemented in SCM by 2035, providing valuable orientations and insights for decision-makers in this field.

Overall, a review of domestic and international studies indicates that blockchain technology can reduce transaction costs, expand transaction scope, and enhance peer-to-peer transactions, creating a new paradigm for decentralized business models. This new paradigm has led to the emergence of supply chain systems leveraging blockchain, which can be more decentralized, innovative, interoperable, borderless, and transparent. Although numerous challenges remain, entrepreneurs and innovators have experimented with decentralized business models that were traditionally unfeasible without blockchain. Successful decentralized business models have the potential to reshape existing industries and create new landscapes for entrepreneurship and innovation. Moreover, they may challenge researchers to develop new theories to explain the potential benefits and costs of decentralization. Blockchain's trust architecture enables transaction automation based on self-enforcing rules, making the process inherently error-free and secure while reducing the need for trust in business partners and ensuring transactions occur as agreed. Against this backdrop, research on how blockchain affects trust relationships among trading partners in trade finance offers a valuable opportunity to deepen our understanding of interpersonal and technological trust dynamics.

Hypotheses:

1. The relative advantage, complexity, confidentiality, data integrity, and data security of the technology are related to the cost of implementing this technology in operations and supply chain management.
2. The relative advantage, complexity, confidentiality, data integrity, and data security of the technology are related to management support for adopting this technology in operations and supply chain management.
3. The relative advantage, complexity, confidentiality, security, management support, data integrity, market dynamics, competitive pressure, and regulatory frameworks are related to blockchain adoption in operations and supply chain management.
4. The cost and complexity of technology adoption have an inverse relationship with blockchain adoption in operations and supply chain management.

3. Methodology

The purpose of this study is to evaluate the factors influencing the adoption of blockchain technology in supply chain management for international trade transactions. The research method is descriptive (survey-based) and correlational in nature. The target population of this study consists of managers from approximately 130 manufacturing companies in the petrochemical industry. According to the Krejcie-Morgan table, when the population size is 130, a sample size of 97 is required. Therefore, from the 130 managers of manufacturing companies in the petrochemical sector, 97 were selected as the final statistical sample. The study employed convenience (non-probability) sampling, where the criterion for sample selection is ease of access. To this end, petrochemical manufacturing companies, each facing distinct challenges and notable advantages in adopting blockchain technology for supply chain management and operations, were examined. Data collection methods in this research are divided into two categories: library-based and field-based. Library-based methods were used to gather information related to the literature review and research background, while field-based methods were employed to collect data for testing the research hypotheses. A questionnaire designed for data collection contains 42 questions, structured based on a Likert scale ranging from (5) "strongly agree" to (1) "strongly disagree," to measure the research variables. The questionnaire was distributed among CEOs and commercial managers of small, medium, and large companies in the petrochemical, industrial, food, and other sectors located in the southern Persian Gulf region and the Tehran offices of international companies active in export and import activities. Each question includes multiple response options, and respondents are required to select one. The responses are designed to be logical for each question while remaining distinct from responses to other questions. Regarding the validity of the questionnaire, it possesses content validity (face validity), achieved by presenting the questionnaire to a group of experts (including the research supervisor and managers of the studied organizations) and obtaining their feedback on the quality of the questions. To assess the reliability of the questionnaire, Cronbach's alpha coefficient was calculated. Cronbach's alpha is a method for evaluating questionnaire reliability based on the internal consistency of the questions. This method is used to measure the internal consistency of measurement tools, such as questionnaires or tests that assess various characteristics. All constructs and measurement items were adapted from prior literature to ensure the validity and reliability of the constructs, as shown in Table 3-1. Items for evaluating relative advantage, complexity, management support, cost, market dynamics, competitive pressure, regulatory frameworks, and behavioral intention were adapted from Wang et al. (2020), items for confidentiality and security from Queiroz and Wamba (2019), and items for data integrity from Dutta et al. (2020). Structural equation modeling (SEM) was used to examine the relationships between the research variables. This method establishes a specific structure between a set of latent and observed variables. Latent variables refer to the main factors represented in a conceptual model. Using SEM, the relationships between latent variables and the measurement items for each latent variable can be analyzed. The AMOS and SPSS software were used for the calculations in this method. In this study, the factors shaping the technology under investigation were first identified. Then, based on the existing theoretical foundations, relationships between these factors were hypothesized, and hypotheses were formulated. After hypothesis formulation and the development of an initial conceptual model, the model was implemented in the AMOS software environment. Finally, the conceptual model was validated using the structural equation modeling method.

4. Findings

To assess convergent validity, composite reliability was calculated. Standardized factor loadings should exceed 0.7, indicating sufficient internal convergence. The composite reliability results are presented in Table 1.

Table 1: Composite Reliability Results for Research Variables

Variable	Composite Reliability	Variable	Composite Reliability
Security	0/925	Relative Advantage	0/910
Management Support	0/931	Cost	0/804
Competitive Pressure	0/932	Blockchain Adoption	0/908
Regulatory Frameworks	0/833	Market Dynamics	0/839
Confidentiality	0/921	Complexity	0/840
Data Integrity	0/908		

All coefficients exceed 0.7, confirming the reliability of the measurement tool.
The Average Variance Extracted (AVE) represents the percentage of variance explained among the items, indicating the average shared variance between each construct and its indicators. The AVE should exceed 0.5 to confirm one of the criteria for convergent validity of the model.

Table 2: Average Variance Extracted (AVE) Results for Research Variables

Variable	Average Variance Extracted (AVE)	Variable	Average Variance Extracted (AVE)
Security	0/804	**Relative Advantage**	0/719
Management Support	0/731	**Cost**	0/674
Competitive Pressure	0/733	**Blockchain Adoption**	0/832
Regulatory Frameworks	0/557	**Market Dynamics**	0/636
Confidentiality	0/854	**Complexity**	0/570
Data Integrity	0/766		

As evident from the results in Table 3, the AVE values for all variables exceed 0.5, indicating adequate convergent validity of the model.
Discriminant validity assesses the relationships between latent variables in the structural equation model based on correlations. It compares the correlation of a construct with itself to the correlations between its indicators and other constructs. To evaluate discriminant validity, the Fornell-Larcker matrix and cross-loadings are examined. The Fornell-Larcker matrix displays the pairwise relationships between latent variables. For discriminant validity under the Fornell-Larcker criterion, the square root of the AVE for first-order latent variables must exceed the correlations between them. To this end, the square root of the AVE for each first-order latent variable (latent constructs) is calculated and compared with the correlations that the variable has with other variables.

Table 3: Fornell-Larcker Matrix for Assessing Discriminant Validity

Variables	Security	Management Support	Competitive Pressure	Regulatory Frameworks	Confidentiality	Relative Advantage	Cost	Blockchain Adoption	Market Dynamics	Complexity	Data Integrity
Security	0/897										
Management Support	0/357	0/855									
Competitive Pressure	0/431	0/714	0/856								
Regulatory Frameworks	-0/080	0/407	0/140	0/746							
Confidentiality	0/787	0/400	0/563	-0/091	0/924						
Relative Advantage	0/656	0/541	0/580	-0/060	0/757	0/848					
Cost	-0/221	-0/364	-0/553	0/111	-0/322	-0/378	0/821				
Blockchain Adoption	0/243	0/707	0/546	0/329	0/259	0/298	-0/248	0/912			
Market Dynamics	0/369	0/347	0/463	-0/004	0/377	0/378	-0/193	0/332	0/797		
Complexity	-0/334	-0/592	-0/562	-0/124	-0/360	-0/498	0/508	-0/368	-0/360	0/755	
Data Integrity	0/746	0/381	0/502	-0/136	0/793	0/722	-0/272	0/166	0/379	-0/405	0/875

As evident from the table, the square root of the Average Variance Extracted (AVE) for each variable is greater than its correlations with other variables, indicating adequate discriminant validity and a good fit for the measurement models.

The second test for assessing discriminant validity involves examining cross-loadings or the matrix of factor loadings. This test evaluates the factor loading of each indicator, ensuring that the loading for its corresponding construct is higher than for other constructs. This confirms that the latent variables in the model are sufficiently distinct (divergent). Table 4 indicates whether the factor loadings of each indicator show the highest correlation with its own construct.

Table 4: Cross-Loadings

Variables	Security	Management Support	Competitive Pressure	Regulatory Frameworks	Confide ntiality	Relative Advantage	Cost	Blockchain Adoption	Market Dynamics	Complexity	Data Integrity
q1	0/527	0/604	0/577	0/078	0/641	0/918	-0/360	0/316	0/340	-0/474	0/581
q2	0/639	0/397	0/448	-0/144	0/726	0/895	-0/305	0/124	0/420	-0/525	0/742
q4	0/632	0/428	0/562	-0/119	0/770	0/907	-0/374	0/227	0/274	-0/353	0/721
q5	0/438	0/356	0/333	-0/064	0/404	0/642	-0/220	0/349	0/248	-0/331	0/396
q6	-0/235	-0/382	-0/407	-0/019	-0/269	-0/422	0/432	-0/181	-0/233	0/846	-0/385
q7	-0/282	-0/372	-0/258	-0/048	-0/259	-0/459	0/304	-0/141	-0/239	0/762	-0/360
q8	-0/304	-0/464	-0/664	-0/075	-0/397	-0/368	0/491	-0/231	-0/228	0/756	-0/334
q9	-0/178	-0/540	-0/291	-0/223	-0/136	-0/26	0/270	-0/531	-0/381	0/642	-0/145
q11	0/722	0/270	0/508	-0/163	0/899	0/630	-0/287	0/175	0/434	-0/326	0/695
q12	0/736	0/444	0/532	-0/028	0/948	0/754	-0/307	0/288	0/289	-0/340	0/765
q14	0/611	0/268	0/368	-0/169	0/685	0/607	-0/263	0/081	0/351	-0/404	0/873
q15	0/740	0/389	0/563	-0/130	0/759	0/679	-0/253	0/216	0/445	-0/380	0/891
q16	0/590	0/330	0/359	-0/058	0/627	0/601	-0/198	0/121	0/177	-0/278	0/861
q17	0/842	0/221	0/242	-0/076	0/689	0/545	-0/045	0/166	0/327	-0/214	0/686
q18	0/956	0/413	0/483	-0/060	0/768	0/630	-0/274	0/287	0/336	-0/346	0/682
q19	0/889	0/260	0/353	-0/091	0/659	0/585	-0/193	0/158	0/343	-0/299	0/673
q20	0/329	0/851	0/588	0/354	0/363	0/428	-0/193	0/688	0/400	-0/433	0/366
q21	0/286	0/895	0/658	0/405	0/295	0/379	-0/357	0/648	0/205	-0/449	0/266
q22	0/280	0/869	0/605	0/430	0/317	0/422	-0/277	0/633	0/181	-0/411	0/200
q23	0/321	0/891	0/663	0/290	0/361	0/549	-0/420	0/610	0/339	-0/675	0/376
q24	0/310	0/764	0/529	0/269	0/376	0/533	-0/297	0/432	0/353	-0/546	0/420
q25	-0/147	-0/306	-0/336	0/041	-0/175	-0/23	0/747	-0/237	-0/356	0/320	-0/191
q27	-0/209	-0/299	-0/545	0/127	-0/331	-0/37	0/889	-0/185	-0/026	0/493	-0/251
q28	0/350	0/214	0/396	-0/137	0/281	0/283	-0/163	0/268	0/848	-0/328	0/303
q29	0/251	0/432	0/441	0/124	0/338	0/339	-0/199	0/319	0/826	-0/351	0/346
q30	0/304	0/102	0/216	-0/032	0/280	0/277	-0/066	0/175	0/711	-0/124	0/236
q31	0/351	0/716	0/886	0/210	0/457	0/518	-0/528	0/532	0/517	-0/627	0/391
q32	0/382	0/745	0/772	0/118	0/464	0/603	-0/382	0/481	0/515	-0/553	0/522
q33	0/317	0/558	0/885	0/160	0/386	0/416	-0/518	0/441	0/281	-0/506	0/317
q34	0/394	0/566	0/922	0/081	0/561	0/506	-0/519	0/467	0/349	-0/431	0/476
q35	0/404	0/418	0/806	0/001	0/551	0/414	-0/407	0/393	0/271	-0/227	0/438
q36	-0/127	0/241	0/109	0/739	-0/114	-0/080	0/080	0/180	-0/072	0/017	-0/073
q37	-0/135	0/228	0/041	0/801	-0/155	-0/170	0/149	0/232	0/100	-0/144	-0/148
q38	0/092	0/489	0/173	0/646	0/085	0/224	-0/034	0/202	0/147	-0/360	0/075
q39	-0/064	0/285	0/107	0/790	-0/078	-0/104	0/112	0/325	-0/132	0/049	-0/196
q41	0/184	0/596	0/492	0/280	0/212	0/238	-0/226	0/902	0/347	-0/401	0/117
q42	0/256	0/689	0/504	0/319	0/258	0/302	-0/227	0/922	0/264	-0/276	0/181

The results of the table indicate that the factor loadings of each indicator exhibit the highest correlation with its respective construct, confirming the discriminant validity of the model.
After verifying the fit of the measurement, structural, and overall models, the research hypotheses were tested. The results of the hypotheses are presented in Table 5. Based on the hypothesis testing results, the relationships between management support and blockchain adoption, data integrity and blockchain adoption, complexity and management support, complexity and cost, and relative advantage and management support were confirmed.

Table 5: Results of the Main Research Hypotheses

Hypotheses	Path Coefficient	T-Statistic	P Values	Hypothesis Result
Security → Management Support	0/016	0/146	0/884	Rejected
Security → Cost	0/145	0/832	0/406	Rejected
Security → Blockchain Adoption	0/116	0/886	0/376	Rejected
Management Support → Blockchain Adoption	0/683	5/360	0/000	Accepted
Competitive Pressure → Blockchain Adoption	0/128	1/062	0/289	Rejected
Regulatory Frameworks → Blockchain Adoption	0/014	0/190	0/849	Rejected
Confidentiality → Management Support	0/041	0/286	0/775	Rejected
Confidentiality → Cost	-0/251	1/239	0/216	Rejected
Confidentiality → Blockchain Adoption	0/088	0/642	0/521	Rejected
Relative Advantage → Management Support	0/341	2/204	0/028	Rejected
Relative Advantage → Cost	-0/130	0/852	0/395	Rejected
Relative Advantage → Blockchain Adoption	-0/118	0/863	0/389	Rejected
Cost → Blockchain Adoption	0/010	0/103	0/918	Rejected
Market Dynamics → Blockchain Adoption	0/120	1/694	0/091	Rejected
Complexity → Management Support	-0/450	5/585	0/000	Accepted
Complexity → Cost	0/430	4/512	0/000	Accepted
Complexity → Blockchain Adoption	0/044	0/386	0/700	Rejected
Data Integrity → Management Support	-0/085	0/705	0/481	Rejected
Data Integrity → Cost	0/082	0/537	0/591	Rejected
Data Integrity → Blockchain Adoption	-0/254	2/205	0/028	Accepted

5. Discussion and Conclusion

The present study aimed to evaluate the factors influencing the adoption of blockchain technology in supply chain management for international trade transactions within petrochemical manufacturing companies. This study examined blockchain adoption factors across technological (relative advantage, complexity, confidentiality, data integrity, and security), organizational (management support and cost), and environmental (market dynamics, competitive pressure, and regulatory frameworks) dimensions. The following discussion evaluates the validity of the proposed hypotheses based on the results obtained from the collected data. The findings indicate that relative advantage, blockchain confidentiality, data integrity, and data security do not have a direct relationship with the cost of using this technology in operations and supply chain management. However, the complexity of blockchain technology has a direct relationship with the cost of its implementation in operations and supply chain management. Similarly, relative advantage, confidentiality, data integrity, and data security do not have a direct relationship with management support for adopting this technology in operations and supply chain management, whereas complexity has a direct relationship with management support. Furthermore, relative advantage, confidentiality, data security, market dynamics, competitive pressure, and regulatory frameworks do not have a direct relationship with blockchain adoption in operations and supply chain management. In contrast, senior management support and data integrity have a direct relationship with the adoption of this technology in operations and supply chain management. Finally, the cost and complexity of blockchain technology do not have an inverse relationship with its adoption in operations and supply chain management.

In summary, in the current market model, establishing and effectively managing a supply chain is a challenging task that impacts not only the profitability of companies and producers but also the final product price. Many challenges in existing supply chains can be addressed through blockchain technology. This study highlights the relationships between hypotheses across technological, organizational, and environmental dimensions. It became evident that, from a technological perspective, organizations utilizing blockchain technology in supply chain management can increase operational speed and achieve numerous benefits due to greater transparency, enhanced security, and improved traceability. However, the association of this technology with cryptography and computer science makes it difficult for most people to understand, leading to common complexities. These can be addressed through organizational investment in training, which can yield significant long-term returns.

Recognizing blockchain as a distributed public ledger has raised concerns about the confidentiality of organizational data, creating barriers to its adoption. However, adopting private blockchain systems, which restrict access to a limited number of managers and specific individuals, can address these concerns, ensure the confidentiality of organizational data and documents, and make adoption and use more feasible. Organizations using blockchain technology can leverage a vast network of nodes to minimize security vulnerabilities against cyberattacks, providing a secure environment for storing organizational documents. Benefits such as security, data integrity, confidentiality, and relative advantages over other supply chain management systems can be achieved by implementing blockchain technology. The use of transparent and advanced blockchain technology enables companies to identify high-cost areas and adopt cost-saving measures. Blockchain can also eliminate transaction fees associated with banks and other money transfer methods. These fees contribute to the final product price and profit calculations, and their elimination can increase profits and reduce costs for customers.

On the other hand, market dynamics are constantly evolving and can profoundly impact any industry, fundamentally altering a company's or organization's trajectory toward progress or regression. Therefore, aligning with market dynamics is a critical consideration for organizational managers, who must continually update themselves and their organizations with technological and market changes. Companies competing in global markets often face competitive pressures that affect their ability to utilize products and transfer competencies and skills internally. These organizations face pressures to reduce costs and respond to local demands, with innovation being a key factor in creating a competitive advantage over rivals. National and international regulatory bodies and governments, by developing policies and procedures to integrate blockchain technology into their structures and applying it in various financial, commercial, and industrial domains, can take significant steps toward encouraging private and public organizations. This creates a conducive environment for the adoption and utilization of various blockchain applications.

Ultimately, this study aimed to elucidate behavioral intention (blockchain adoption) in the context of supply chain management, while considering the willingness of adopters in Iran. The model was estimated using a structural equation modeling approach, and the results supported the proposed model. However, significant differences in the willingness to adopt blockchain were observed across the studied country. Undoubtedly, blockchain technology can significantly transform the global business environment, leading to fundamental and structural changes in business operations. However, to harness the immense potential of this technology, various challenges in the adoption and sustainability of blockchain must be addressed before its legal, economic, and technical capabilities can be fully realized in various business applications. Researchers can conduct further studies to measure the costs, revenues, profits, and investments related to different blockchain and business domains. More importantly, they can explore the relationship between blockchain awareness and the adoption of its applications in supply chain management. Such research will help elucidate the role of blockchain technology in business management.

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ETHICAL CONSIDERATION

Authenticity of the texts, honesty and fidelity has been observed.

CONFLICT OF INTEREST

Author/s confirmed no conflict of interest.