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# The Potential of Blockchain Technology in Facilitating International Trade

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## Abstract

This paper investigates the potential application of blockchain technology in international trade. It provides an overview of blockchain technology, its application in global trade and includes successful use cases. The article analyzes the impact of blockchain technology on supply chain transparency and efficiency, regulatory obstacles and relevant factors. In addition, it investigates how blockchain technology can transform international trade, explores current trends, and addresses scalability and interoperability challenges. In conclusion, this article conducts a comprehensive analysis of blockchain's potential in global trade and ends with recommendations for future research and practical application.

**Keywords:** blockchain technology, global trade, transparency, efficiency.

## 1. Introduction

### 1.1. Blockchain technology and its relevance to international trade

Blockchain is a distributed ledger technology that connects transaction records in blocks and deploys cryptographic algorithms to guarantee the security and immutability of data. The fundamental concept behind blockchain is decentralization and de-trust, where transaction authentication and recording rely on a consensus mechanism among network participants, eliminating the need for a central authority.

Each block stores a set of transaction records and includes a hash value that points to the previous block, creating an immutable chain structure for the data stored on the blockchain. By following this design, the data on the blockchain is kept secure and reliable due to the creation of an immutable chain structure. New transactions are verified through a consensus algorithm by network participants who add them to a new blockchain block.

Blockchain technology is extensively and significantly used in international trade. It has transformed supply chain management, facilitating real-time traceability and transparency through smart contracts and distributed ledger technology. This helps supply chains operate more efficiently, decreasing delays and storage costs.

Blockchain technology can help resolve trust issues in international trade. Blockchain records transaction data and shares it, providing highly secure and tamper-proof transaction records. This allows participants to verify the origin, authenticity and quality of goods. The trustworthy information provided helps to combat the circulation of substandard goods, reinforcing consumer trust and enhancing brand reputation.

In terms of payments, blockchain technology provides quick, secure and low-cost solutions for cross-border transactions. Cross-border payments can become more efficient, transparent and reduce transaction costs through the automated execution of smart contracts and the lack of intermediaries. This solution can be particularly helpful for SMEs by reducing trade costs and enhancing competitiveness.

Furthermore, the use of smart contracts with blockchain technology can help simplify the process of trade contract management and execution. By encoding contract terms in the blockchain, contract participants can automate enforcement, ensuring contract compliance and accuracy. This automated system reduces the risk of contractual disputes and enhances transactional efficiency and reliability.

The application of blockchain technology in international trade enhances supply chain management, trust, cross-border payments, and simplifies trade contract management. These applications drive the development and innovation of international trade by improving efficiency, credibility, and competitiveness of commercial entities.

## **1.2. Analysis of problems that may be encountered in the application of blockchain technology in international trade**

Blockchain technology has shown diverse applications in international trade, although several challenges still need to be addressed. Standardisation and interoperability are key challenges for blockchain technology due to the absence of consistent standards for current systems. Achieving seamless data interaction between different systems is challenging because of this. The issue of scalability is also a challenge that necessitates attention, mainly when handling large-scale transactions and data. Blockchain technology risks facing a performance bottleneck. Another significant consideration is privacy and data protection. While confidentiality of commercial data is crucial in international trade, the transparency of blockchain technology may pose privacy issues. Furthermore, the discrepancies present in the legal and regulatory environment can create obstacles for the utilisation of blockchain technology in international trade applications. For blockchain technology to be compliant with international trade regulations, it necessitates cooperation and coordination across borders.

To conquer these challenges, advancements in technology, collaboration, and policy backing are essential to warrant standardisation, scalability, confidentiality, pragmatic and feasible legal, and regulatory frameworks. Thus, the promotion of blockchain technology in international trade could be enhanced. This article analyses the aforementioned issues and proposes corresponding recommendations.

## **1.3. Outline the specific objectives and goals of the research paper**

This paper aims to investigate the potential role of blockchain technology in international trade. It also strives to analyze the future potential of the technology in facilitating international trade and provide relevant recommendations in this regard.

# **2. Overview of Blockchain Technology and its Potential Applications**

## **2.1. A comprehensive definition of blockchain technology and explain its core characteristics**

Blockchain, being a decentralised distributed ledger technology, offers numerous applications in businesses. Blockchain's main characteristics comprise distributed ledger, immutability, transparency, decentralisation, anonymity, and authentication.

To begin with, distributed ledger permits storing transactions and data records on various nodes within the network in a decentralised manner, which enhances data reliability and security. On the contrary to traditional centralised institutions where there is a risk of a single point of failure, the decentralised nature of the blockchain eliminates this potential issue.

Secondly, the integrity and trustworthiness of transactions and data is ensured by the ability to prevent tampering with the blockchain. After the data is written to the blockchain and confirmed sufficiently, it cannot be modified or removed arbitrarily. Cryptographic algorithms and consensus mechanisms guarantee the security and reliability of data through blockchain technology.

Another important feature of blockchain technology is transparency. Data records and transactions on the blockchain are publicly visible and open for verification by anyone. This transparency increases the trustworthiness of transactions and reduces information asymmetry.

In addition, the decentralised nature of blockchain reduces the number of trust links by eliminating intermediaries in traditional business models. This improves the security and reliability of transactions.

Furthermore, blockchain technology offers the dual characteristics of anonymity and authentication. Users have the option to employ anonymous addresses when performing transactions to safeguard their anonymity. Nevertheless, there are situations where identity verification becomes necessary, especially to comply with regulatory requirements.

As a new type of digital technology based on cryptographic algorithms, consensus mechanisms and smart contracts, blockchain technology is able to effectively enhance social consensus and trust and reduce the cost of social governance, and has thus become a new means and tool for the modernisation of social governance. However, in order for blockchain technology to effectively play its role as the underlying technology of social governance modernisation, it needs to be demanded, selected, evaluated and regulated by society in order to achieve efficient and convenient governance. Blockchain technology is not formed and developed independently, but has to rely on social factors since its birth, and its development depends on the degree of meeting social needs, and its application depends on the existence of social support conditions. Therefore, the formation and development of blockchain technology cannot be separated from the participation of social actors and social shaping<sup>19</sup>.

## **2.2. Various potential applications of blockchain in the context of international trade**

Blockchain is a sophisticated computer application that functions as a shared data platform. The security and reliability of data on the blockchain are ensured by storing it on multiple nodes in a network that utilize cryptographic algorithms and consensus mechanisms. Blockchain's decentralized nature supports decentralized data storage, thereby avoiding the risks of single points of failure and data tampering.

Blockchain's complete transparency ensures that all transactions and data records are publicly visible for all participants to view and verify, thus enhancing transparency and trust in transactions. All participants can view and verify this data, enhancing transparency and trust in transactions. The blockchain platform's untraceability also ensures data integrity and trustworthiness by making it challenging to manipulate or erase recorded data. This attribute guarantees the integrity and trustworthiness of transactions.

The consensus mechanism is also a critical blockchain attribute that enables co-maintainability. The overall security and stability of the blockchain is ensured as participants negotiate and reach consensus to validate transactions.

The inherent immutability of transactions and data records in blockchain enables participants to collaborate without worrying about information asymmetry or issues of trust. This transparency and trustworthiness contribute towards forming a secure foundation for partnerships across various fields, thereby facilitating their establishment and development.

Numerous technology and innovation firms across the globe are presently engaged in developing and implementing groundbreaking blockchain applications in the financial sector. Currently, the use of blockchain technology in the financial sector presents a wide range of possibilities.

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19. Gad, A. G., Mosa, D. T., Abualigah, L., & Abohany, A. A. (2022). Emerging trends in blockchain technology and applications: A review and outlook. *Journal of King Saud University-Computer and Information Sciences*, 34(9), 6719-6742.

Decentralized Finance (DeFi) represents the primary breakthrough in blockchain technology within the financial sector. DeFi applications enable financial transactions without the involvement of third-party intermediaries through the use of smart contracts, such as lending and borrowing, decentralized exchanges, and liquidity mining. Traditional financial transactions necessitate verification and clearance by several intermediaries. The decentralised nature of blockchain facilitates direct peer-to-peer transactions, which lowers transaction costs by eliminating intermediary links. Blockchain technology allows for permanent recording of transaction records on the blockchain network ensuring both.

Transparency and traceability of transactions. This decentralised financial framework provides unprecedented prospects for implementing transparent, efficient and open financial services.

Secondly, blockchain technology has played a significant role in shaping the digital currency and payments sector. Blockchain offers a range of novel options for conducting global financial transactions, through digital currencies such as Bitcoin, Ethereum, stablecoins and others. The traditional method of international payment often includes intermediation via multiple banks and clearing houses, leading to high costs and time consumption. Blockchain technology enables real-time peer-to-peer payments for cross-border trade and personal remittances, with the potential to offer faster and more cost-effective transactions while increasing payment security. The decentralised nature of blockchain technology makes cross-border payments and real-time settlements more convenient, cost-effective, and secure.

Another significant area where blockchain technology can be applied is in the financial sector of the supply chain. The use of blockchain technology can improve the efficiency and reliability of financial services provided in the supply chain. Creating a traceable supply chain network that allows for information sharing and automated transaction financing enhances the transparency and speed of capital flow in the supply chain.

Moreover, blockchain technology has a considerable influence on digital security management and asset handling. The decentralized ledger and smart contracts of this technology permit digital securities' automated management, trading and issuance. As a consequence, the transactions' transparency and efficiency are improved, and intermediaries' participation costs are reduced.

Finally, blockchain technology offers innovative techniques for managing risks and complying with regulations. The unchangeable nature of blockchain combined with its ability to monitor transactions in real-time can enhance risk assessment and monitoring systems, and reduce fraud and non-compliance.

## 2.3. Inherent challenges and limitations associated with blockchain technology

### 2.3.1. Technical aspects

Regarding scalability, current public blockchains like Bitcoin and Ether usually face hindrances in performance while processing voluminous transactions. As blockchains are distributed in nature, each node has to reproduce and authenticate every transaction, which restricts the processing power and throughput of transactions. To alleviate this issue, it is necessary to investigate further solutions like enhancing consensus algorithms, implementing sharding techniques, and introducing sidechains and lightning networks.

Traditional blockchains have been designed to be transparent and open in terms of privacy and confidentiality, displaying all transaction information on their chains. In some cases, it is essential to safeguard users' privacy and sensitive data. Presently, privacy-preserving methods involve the use of techniques such as zero-knowledge proofs, ring signatures, and cryptographic algorithms that enable anonymity and data privacy.

Blockchain technology poses another significant challenge that concerns security. Consensus algorithms and cryptographic mechanisms are the key factors that determine the security of blockchain. Despite this, new security vulnerabilities and attacks continue to emerge, such as the 51% attack, double-flower attack, and smart contract vulnerability. To preserve blockchain security, it's crucial to continuously analyze vulnerabilities and enhance security measures, as well as strengthen node authentication and network defence mechanisms.

Similarly, the "Prism Gate" incident also reflects that there are many data leaks in reality, and the security of storage is a pain point for the general audience. Therefore, in "blockchain + cross-border payment", firstly, it is necessary to reduce the risk of passwords being deciphered, such as setting up a certain level of protected access rights for public and private keys, which is also the first condition for economic entities to accept the application

of blockchain technology in cross-border payment, i.e., security guarantee. Second, strengthen the construction of firewalls. Because of the decentralisation feature of blockchain technology, it is an open system, and nodes can share information after logging in, while the database of blockchain is often open and transparent, which provides a sense of security for users, but also provides opportunities for intrusion of lawless elements, so in order to maintain security under the premise of guaranteeing the transparency of information, the technological upgrade and construction of firewalls is the most important thing. Therefore, the technical upgrading and construction of firewalls is a top priority in order to maintain security while ensuring information transparency<sup>20</sup>.

### 2.3.2. Legal regulatory level

The decentralised nature of blockchain technology makes it challenging to apply traditional compliance and regulatory models to blockchain applications, especially those that cross borders. As a result, it is necessary to develop regulations and regulatory frameworks that ensure blockchain applications conform to legal requirements and prevent illegal activities, such as money laundering and other financial flows.

Regarding data privacy and protection, the transparent and open nature of the blockchain may infringe on the legal requirements for personal data protection. To resolve this matter, it is necessary to define how sensitive information is to be protected and handled in order to respect personal data privacy and comply with regulations.

Moreover, although smart contracts are a fundamental application of blockchain technology and allow for automated and tamper-proof contract execution, the legal responsibilities and dispute resolution mechanisms require clearer definition. To ensure that smart contracts are compliant with legal requirements and provide appropriate remedies for the parties, there is a need for further research and development of the relevant legal framework.

At this stage, 86 per cent of the world's central banks are accelerating their research and development of digital currencies, and the accompanying ecological alliances such as the construction of legal frameworks are also following suit, with China's research and development in this area already ahead of other major economies. China is already ahead of other major economies in this area, which is why China's legal and regulatory research needs to develop at a rapid pace.

The decentralized and cross-border nature of blockchain is increasingly challenging traditional compliance and regulatory models. Regulators must establish suitable regulations and regulatory frameworks to ensure compliance with blockchain applications and prevent illicit activities. For example, regulatory bodies must enforce national and regional regulations to govern digital currency exchanges' operations, including real-name requirements and anti-money laundering measures.

Secondly, blockchain's open and transparent nature may contradict legal obligations for personal data protection. Governments and regulatory bodies must balance data privacy and compliance. The EU's General Data Protection Regulation (GDPR) demands stringent security of personal data, but information on a publicly available blockchain may raise issues of personal privacy. To protect personal data in blockchain applications, especially those involving medical records or identity verification, technical measures such as anonymisation, encryption, and decentralised control are necessary.

Besides, smart contracts face legal constraints. Smart contracts, as one of the primary features of blockchain technology, can enforce contract terms automatically. Nevertheless, legal responsibilities and dispute resolution avenues require further clarity in case of errors or disputes. For instance, there must be a clear definition of legal liabilities and remedies when a smart contract loophole or mistake prevents contract fulfilment or results in losses. Legal disputes regarding vulnerabilities in smart contracts like the hacking of Decentralised Autonomous Organisations (DAOs) have already arisen. One way to solve this problem is to clarify the legal limitations of smart contracts, dispute resolution mechanisms, and contract cancellation conditions within the legal framework.

It is essential to prioritize cross-border compliance and regulatory cooperation. The cross-border nature of blockchain technology makes it necessary for countries and regions to cooperate to achieve effective regulation and compliance. For instance, cross-border blockchain projects may entail several jurisdictions with varying compliance and regulatory requirements. Thus, international cooperation and the establishment of common regulatory

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20. Böhmecke-Schwafert, M. (2024). The role of blockchain for trade in global value chains: A systematic literature review and guidance for future research. *Telecommunications Policy*, 102835.

standards are crucial in addressing cross-border regulatory concerns. Certain countries have collaborated to generate international standards for compliance, such as the Financial Action Task Force (FATF) guidelines for Virtual Asset Service Providers (VASPs).

### 3. The Impact of Blockchain Technology on Supply Chain Transparency and Efficiency

The utilization of blockchain technology holds significant potential in addressing trade financing challenges, enhancing transparency within supply chains, streamlining the export process, and facilitating MSMEs' engagement in government procurement. Employing blockchain technology enables MSMEs to effectively resolve trade financing issues, bolster visibility throughout the supply chain, optimize export operations, and enable seamless participation in government procurement, thus augmenting their prospects in international trade.

Nevertheless, it is worth noting that MSMEs currently encounter numerous obstacles when adopting blockchain solutions. To ensure widespread implementation of blockchain technology, industry experts suggest adopting an inclusive approach that encompasses both larger enterprises and smaller MSMEs. Governments play a vital role in fostering an inclusive environment for blockchain promotion and integration. By formulating policies and allocating resources, governments can provide vital support to ensure the inclusivity and accessibility of blockchain development.

In conclusion, the integration of blockchain technology offers considerable advantages for MSMEs, such as the resolution of trade financing challenges, heightened supply chain transparency, streamlined export processes, and improved access to government procurement opportunities. While MSMEs face obstacles in adopting blockchain, an inclusive approach that involves government support and collaboration between larger enterprises and MSMEs can pave the way for successful blockchain implementation and overall advancement in the realm of international trade.

#### 3.1. Significance of transparency in international trade and its relationship to supply chains.

Transparency assumes a pivotal role in international trade, serving as a crucial component of effective supply chain management. It encompasses the visibility and openness of information, enabling participants to access accurate, real-time data through the sharing of transactional and supply chain information. Extensive research supports the significant role of transparency in establishing trust, improving operational efficiency, reducing costs, and promoting sustainable development.

Trust forms the bedrock of business transactions, and transparency plays a vital role in cultivating a trustworthy relationship between transactional parties. By facilitating the transparent sharing of specific and clear data, it effectively mitigates uncertainties and risks, providing participants with valuable insights into the behavior and circumstances of other stakeholders. This transparency fosters cooperation in the supply chain, eliminating information asymmetries and enhancing transactional reliability and stability.

The adoption of blockchain technology is an indispensable solution if we want to accelerate the pace of the integration of production and financing in international trade. The decentralisation, full trace-keeping and open and transparent institutional mechanism of blockchain technology can bring a shared industrial chain system to all trading subjects in international trade, further enable the free and accurate flow of currency, commodities and funds, so that market trading subjects can clearly grasp the flow of goods and whether funds are in possession, and form an automated and transparent green industrial chain platform. The platform will form an automated and transparent green industrial chain<sup>21</sup>.

Furthermore, transparency plays a pivotal role in enhancing trade efficiency. Real-time information sharing

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21. Deepa, N., Pham, Q. V., Nguyen, D. C., Bhattacharya, S., Prabadevi, B., Gadekallu, T. R., ... & Pathirana, P. N. (2022). A survey on blockchain for big data: Approaches, opportunities, and future directions. *Future Generation Computer Systems*, 131, 209-226.

empowers participants to track and verify data during transactions and logistics, thereby minimizing errors and delays and optimizing overall trade processes. Supply chain managers can proactively identify and address potential problems, allowing for timely resolution and avoidance of additional costs and time wastage.

Moreover, transparency significantly contributes to reducing trade-related expenses. By promoting information transparency, it mitigates the risks of theft, fraud, and illicit activities, thereby reducing trade losses and related costs. A comprehensive understanding of the various entities and processes within the supply chain enables the avoidance of unnecessary risks and financial losses, ultimately enhancing trade efficiency and economic viability.

Finally, transparency is closely intertwined with sustainable development initiatives. It facilitates the establishment and regulation of sustainable supply chains by ensuring product traceability and compliance with environmental and social responsibility standards. Transparent data tracking empowers regulatory bodies to monitor the origins, production practices, quality standards, and conformity to sustainable principles, promoting the pursuit of sustainable development goals.

### 3.2. How blockchain enhances supply chain visibility, traceability, and overall efficiency

The integration of blockchain technology into supply chain management improves visibility, traceability, and overall efficiency. The distributed and shared ledger mechanism of blockchain allows supply chain participants to access transaction and logistics data in real-time, thus enhancing the visibility of the supply chain. Through transparent data logging and visualization dashboards, supply chain managers can obtain up-to-date information about inventory levels and product flow status.

The blockchain's tamper-proof structure ensures high traceability within the supply chain. Each logistics and transaction node is recorded in a secure block, enabling participants to trace product origin, manufacturing processes, and transport routes. In cases of quality issues or recalls, the affected batch or product can be swiftly identified, reducing potential risks and losses. This traceability enhances supply chain reliability and fosters consumer trust.

Furthermore, blockchain technology enhances supply chain efficiency through the use of smart contracts. Smart contracts automate the execution of eligible transactions and payments, eliminating the bureaucratic procedures and time delays associated with traditional supply chain management. By sharing data and receiving real-time updates, participants improve logistics, transportation, and payment efficiency, reducing information asymmetry. The removal of intermediaries and streamlining of processes in blockchain technology reduce complexity, resulting in improved operational efficiency and transport within the supply chain.

The integrated framework also provides heightened security to the blockchain. The decentralized structure and encryption algorithms of blockchain ensure data security and integrity. Transactions recorded in tamper-proof blocks prevent data tampering and fraudulent activities, enhancing the stability and protection of the supply chain.

In conclusion, the integration of blockchain technology in supply chain management offers improved visibility, traceability, efficiency, and security. The ability to access real-time data, track product information, and automate transactions contributes to the effective management of the supply chain. However, it is worth noting that there are technical, regulatory, and collaborative challenges associated with implementing blockchain technology. As technology progresses and adoption rates increase, blockchain has the potential to play a significant role in the field of supply chain management.

Combining theory and practice, supply chain visibility is believed to enhance diverse capabilities in addressing problems and challenges arising in the supply chain system, which result in improved economic and sustainable performance<sup>22</sup>. Previous research has examined the "triple bottom line" performance of businesses and revealed that enhanced supply chain visibility can substantially enhance the companies' social, environmental, and economic performance<sup>23</sup>.

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22. Jiang Yishe. (2021). The Impact of Big Data Analysis Capability and Supply Chain Visibility on Mass Customisation Capability (Master's thesis, Harbin Institute of Technology). <https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202201&filename=1021903761.nh>

23. Dubey, R., Gunasekaran, A., Childe, S. J., et al. (2020). Upstream supply chain visibility and complexity effect on focal company's sustainable performance: Indian manufacturers' perspective. *Annals of Operations Research*, 290(1-2), 343-367.

### 3.3. Specific case studies and research demonstrating the positive impact of blockchain on supply chain processes

A related study published in the journal *Annals of Operations Research* examines the impact and relationship of supply chain visibility on various aspects of firm performance. The study analysed an empirical data of a manufacturing firm. The study's findings reveal a positive association between increased supply chain visibility and firm performance. To be specific, increased visibility contributes to reduced operational risk, improved collaboration, lower inventory costs, and better delivery on-time performance.

Moreover, the study highlights the importance of collaboration and trust in supply chain relationships which significantly influence the relationship between supply chain visibility and firm performance. Enhanced supply chain collaboration and trust contribute to better communication and information sharing, and thereby, further improve the positive impact of supply chain visibility on firm performance.

This study has important implications for companies and professionals in the supply chain industry. It emphasizes the vital role that supply chain visibility plays in enhancing operational efficiency, reducing costs, and increasing customer satisfaction. Therefore, companies must prioritize and implement actions to improve supply chain visibility. This will help to optimize operational efficiency, reduce costs, and increase customer satisfaction.

Secondly, let us analyze the collaboration between IBM and Huadi Electric.

The collaboration seeks to leverage blockchain technology to enhance supply chain processes and improve product sourcing and quality tracking. By utilizing the distributed ledger and smart contract capabilities of blockchain technology, IBM and Huadi Electric have succeeded in achieving supply chain transparency and traceability. This systematic tracking mechanism reduces the risk of counterfeit and poor-quality products entering the supply chain, improving product credibility, and sustainability.

The third case is a collaborative study conducted by Maersk and IBM. The study's aim is to enhance global trade supply chain processes by using blockchain technology. They enabled the tracking and verification of goods by developing a blockchain-based global trade platform. The study demonstrated that blockchain technology reduces manual processes and paper documents while improving delivery efficiency and data accuracy. This enhances supply chain visibility, collaboration, and efficiency.

Next, I examine the example of Walmart's utilization of the Food Trust platform. Walmart collaborated with IBM to construct the Food Trust platform by utilizing blockchain technology to trace food products' origin, production, and shipping process. This platform improves consumer confidence in food products' quality, safety, and sustainability while increasing the transparency and dependability of the food supply chain. By utilizing blockchain's unchanging and decentralized nature, the Food Trust platform assures the security and integrity of supply chain data.

### 3.4. The role of trust, security, and information sharing in the context of blockchain - enabled supply chains

Trust is a crucial factor within blockchain supply chains. Traditional supply chains may encounter trust issues among participants; however, blockchain resolves this by fostering trust through its decentralised and transparent nature. The distributed ledger technology of blockchain captures every transaction and operation, with viewing and verifying capabilities for all participants. In turn, transparency and trustworthiness of transactions are enhanced.

Furthermore, blockchain ensures heightened security levels. Data and information are stored and transmitted in an encrypted form on the blockchain. This data is verified and recorded by multiple nodes in the network which reduces the risk of data tampering or loss. The consensus mechanism of the blockchain ensures that only verified and authorised transactions are added to the blockchain. As a result, the security of the supply chain network is further enhanced.

Moreover, blockchain promotes information sharing and transparency. Supply chain participants can share data and information in real-time, thus providing real-time visibility into the supply chain through the blockchain sharing mechanism. As a result, this enhances collaboration and responsiveness within the supply chain and allows participants to better coordinate and respond to supply chain activities.



## 4. Regulatory Challenges and Considerations for the Use of Blockchain

### 4.1. Provide an overview of the existing regulatory landscape and frameworks relevant to blockchain in international trade

Compatibility between blockchain technology and legal and regulatory frameworks at a national and regional level is a significant concern. The decentralized and traceable nature of blockchain can potentially conflict with regulatory compliance. Therefore, comprehensive research is essential to guarantee compliance with various international regulatory requirements regarding blockchain and to establish methods to encourage international cooperation and standardisation.

This would enable the resolution of practical issues concerning the current legal conflict.

Blockchain technology in international trade requires a highly self-controllable and anonymous smart contract system for smooth operation. The adjustments to traditional international trade laws primarily address creditworthiness issues which may arise during cross-border capital operations, creating some disharmony between existing financial laws and blockchain technology<sup>24</sup>.

At present, the legal system lacks provisions for the taxation of blockchain, and digital currency transactions lie outside the scope of taxation. Moreover, there are no specific regulations regarding the payment of taxes for these transactions.

### 4.2. Privacy and data protection concerns related to cross-border transactions facilitated by blockchain technology

The transparency and immutability of the blockchain enable the storage of transaction data on the chain for extended periods. However, this also increases the risk of data leakage and violations of privacy.

Blockchain technology is a decentralised, public, shared ledger where data is stored and accessible to all users on the network level, directly removing information bottlenecks that may occur in the international trade supply chain. However, a significant amount of enterprises and affiliates' core content will unavoidably be kept on the blockchain, which could lower transaction costs but also potentially result in business information leakage or misuse. Moreover, financial recourse for international trade parties could become a significant challenge due to the misuse of blockchain technology.

These issues involve several aspects that require attention.

The first aspect to consider is the use of permission control and anonymisation techniques to safeguard data privacy. Access control mechanisms provide restricted data access, allowing authorised participants to access specific data, while others can only view anonymised data. This measure helps protect both commercially sensitive information and personal privacy to a certain extent.

The second aspect is that cross-border transactions typically involve multiple countries, each having its data protection laws and regulations. Researchers can investigate the development of compliance strategies that adapt to the data protection requirements of different countries. To meet data protection regulations and ensure data compliance and security, techniques such as data encryption and anonymisation are used to process and transmit data.

New solutions for cross-border transactions are provided by evolving privacy-preserving technologies. The legitimacy of transactions can be verified without exposing data details, through techniques such as zero-knowledge proof and homomorphic encryption. Research exploring the application of these technologies for personal data privacy protection and transaction compliance can be conducted.

Privacy and data protection can also be ensured by establishing compliance frameworks and industry standards. To ensure privacy and data protection in cross-border transactions, relevant stakeholders and regulators can collaborate to establish harmonised data protection standards that offer clear guidance to businesses and individuals.

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24. Zhang, L. & Zhang, Z. A. (2023). Research on legal risk control of blockchain technology applied in international trade. *Business Economics* (03), 100-103. doi:10.19905/j.cnki.sjy1982.2023.03.029.

### 4.3. Strategies or recommendations to address the regulatory challenges and foster blockchain adoption.

Developing a clear regulatory framework is imperative for establishing effective regulation and compliance standards for blockchain technology. Collaboration with industry experts and practitioners is necessary to devise transparent and consistent regulations. Simultaneously, regulators should continuously educate themselves, undergo training, and share knowledge to better understand the advancements of blockchain technology.

For ensuring compliance within the blockchain technology realm, a well-defined regulatory framework is crucial. For example, the government could institute a specialized regulatory body for blockchain to formulate regulations and policies relevant to cryptocurrencies and smart contracts. The entity could cooperate with industry experts and practitioners to create transparent and consistent regulations, which would safeguard the interests of investors and ensure market stability. For instance, the Financial Action Task Force (FATF) in the United States is an exemplary successful initiative in this domain. The FATF has established international standards that focus on preventing money laundering and financing of terrorism. It collaborates with national regulators to promote the harmonization of blockchain regulations worldwide.

Industry organizations can collaborate with regulators to develop compliance standards and best practices. For instance, in the financial sector, cooperating with central banks can promote the compliant adoption of digital currencies. One noteworthy example is the pilot project carried out by the Chinese central bank, in collaboration with numerous commercial banks, which centres on the digital RMB. The aim of this project is to ensure compliance with regulatory requirements for digital currencies while also fostering innovation in fintech.

To regulate blockchain technology effectively, it is critical to establish a clear regulatory framework and compliance standards, alongside industry collaboration and continuous education and training for regulators. Regulators can enable responsible and secure implementation of blockchain technology, encouraging innovation and contributing to the development of the digital economy through the adoption of transparent and uniform regulations, protection of investor interests, and promotion of compliance. This will also promote a harmonious global environment for blockchain regulation, fostering a conducive regulatory environment for stakeholders in the field.

Additionally, considering the technical specifications and characteristics of blockchain, it is necessary to supplement and enhance the existing laws and regulations to address the issue of legal ambiguity. Furthermore, the legal framework should be upgraded in line with the technical features of blockchain technology, and the legal status of blockchain in international trade applications should be clarified elucidated. In view of the inherent characteristics of blockchain technology, it presents an arduous task to regulate and maintain control over the technology, hence the requirement for government departments to continuously revise and bolster regulations using professional technology. The banking and financial industry plays a pivotal role in international trade. It's regulatory department can take the first step by devising a preliminary framework for the regulation of blockchain technology, followed by the issuance of initial guidelines to local financial institutions for compliance. It can then base the creation of a specialised regulatory agency on the feedback received through regular reports.

Regulators could enhance their inspection and regulation of blockchain technology by emphasising cybersecurity, data privacy, and consumer protection. To illustrate, the European Union has boosted the safeguarding of personal data privacy by implementing the General Data Protection Regulation (GDPR). Moreover, regulators may motivate companies to create security audits and technical monitoring systems that can guarantee the secure and compliant operation of blockchain applications. An example of this approach is that bitcoin exchanges are obliged by regulators to furnish KYC (Know Your Customer) and AML (Anti-Money Laundering) compliance standards in order to ensure adherence and to safeguard the security of user-owned assets.

Promoting education and outreach is crucial for enhancing public and business awareness and acceptance of blockchain technology. Regulators can organise various activities, such as training courses and seminars, to improve the knowledge of blockchain technology among regulators and practitioners. Additionally, raising awareness about the potential and benefits of blockchain technology can aid public and business understanding and implementation of the technology. The Monetary Authority of Singapore (MAS) is a noteworthy example. It has advanced the awareness and usage of blockchain technology in the financial sector by conducting seminars and organizing a blockchain innovation challenge.

## 5. Future Prospects for Blockchain Technology in Transforming Global Trade

### 5.1. Emerging trends, innovations, and developments in the field of blockchain technology

In the blockchain technology field, emerging trends, innovations and developments continue to evolve dynamically.

Blockchain Features	Distributed storage of data, smart contracts, trustworthy, decentralised, information transparency, tamperproof
Classical blockchain composition	Data Layer, Network Layer, Consensus Layer, Incentive Layer, Contract Layer, Application Layer
Blockchain form	Public chain, private chain, alliance chain
Stages of blockchain development	Blockchain 1.0 Digital Currency Stage, Blockchain 2.0 Smart Contract Stage, Blockchain 3.0 Extended Application Stage
Scenario Applications of Blockchain in International Trade	Full-process collaborative services, paperless process operation, foreign trade logistics supervision, international settlement and digital finance, import and export commodity traceability

Figure 1: Characteristics of blockchain, scenario applications in the field of international trade  
Source: Publicly available data on the web

Firstly, Decentralised Finance (DeFi) is currently a popular topic. It involves building financial systems that don't rely on intermediaries, through the use of smart contracts and distributed ledger technology. DeFi applications, including decentralised exchanges, lending platforms, stable coins and prediction markets, offer users more open, efficient and transparent financial services.

Secondly, privacy protection is now a significant concern in the field of blockchain technology. To address this issue, techniques such as zero-knowledge proof, homomorphic encryption and multi-party computation have been widely studied to protect users' personal information and transaction data, while still maintaining the tamperability and decentralised nature that are inherent in blockchain technology. The aim of these techniques is to protect users' personal information and transaction data, while retaining the tamperability and decentralised nature which are key advantages of blockchain technology.

Cross-chain technologies and interoperability have gained significant attention due to multiple blockchain networks' emergence, necessitating the transfer of data and assets across chains. Cross-chain technologies, including atomic swaps, side-chains, and relay chains, have been extensively researched and implemented to enhance interoperability within the blockchain ecosystem.

With the increasing concern over environmental problems resulting from energy consumption and carbon emissions, sustainable development has emerged as a significant area of innovation. Green blockchain projects and protocols have emerged with the purpose of decreasing blockchain energy consumption and promoting sustainable blockchain development through the adoption of clean energy, energy-efficient algorithms, and consensus mechanisms.

Additionally, there has been a proposal for centralised financial bridging technology that aims to connect traditional and blockchain-based finance. This technology aims to provide users with greater liquidity, lower transaction costs, and improved accessibility to financial services. This technology helps to create a bridge that encourages better cooperation between centralised and decentralised finance.

As a final point, enterprise-level blockchain solutions are becoming more prominent. In addition to cryptocurrencies and financial applications, blockchain technology is crucial in creating trustworthy and verifiable enterprise networks. Such solutions offer a secure, transparent, and efficient method to record and verify data, which can be applied in various domains like supply chain management, digital identity verification, and intellectual property protection.

## 5.2. Assess the scalability and interoperability challenges faced by blockchain in the context of global trade.

One of the significant obstacles for the utilization of blockchain in international trade is its limited scalability. Since each block in a blockchain must be verified by all nodes on the network, the system often bogs down when processing large numbers of transactions, leading to delays in transaction processing, which is a major problem in the operation of blockchain technology in the field of international trade<sup>25</sup>.

For example, the challenges faced by the Bitcoin network in handling highly concurrent transactions result in long transaction confirmation times. To address this issue, projects such as the Lightning Network have been proposed as a second-tier solution for Bitcoin, aiming to improve Bitcoin's transaction scalability and expand its use in global trade.

Another challenge is interoperability between blockchain systems. Global trade involves multiple participants and multiple systems, such as supply chain management, cargo tracking, and payment systems, each using different standards and technologies. To enable interoperability between systems, the International Trade Digitalization Initiative (ITDI) is an initiative to promote standardisation and interoperability in global trade. The initiative aims to facilitate connectivity and data exchange between different blockchain systems by developing common interface specifications and promoting standardisation efforts. Another possible risk is the identification of significant inadequacies in the privacy framework, which may allow malicious players to exploit system vulnerabilities and engage in fraudulent or deceptive activities. Regarding the traceability of products, blockchain technology poses challenges when it comes to evaluating the role of potentially harmful nodes that may adversely affect food safety monitoring.

## 5.3. Insights and predictions on the long-term impact of blockchain on international trade practices and systems

Blockchain technology has a wide range of potential applications in international trade. First, blockchain's decentralised, untamperable and traceable features bring significant improvements to supply chain management. By recording and sharing transaction data on the blockchain, participants can achieve real-time and reliable logistics tracking and traceability, reducing the risk of information asymmetry and fraudulent behaviour. This transparency enhances trust and reliability of transactions.

In addition, blockchain can streamline and automate international trade processes, increasing efficiency and reducing costs. Smart contracts are automated contracts executed on the blockchain that enable real-time, transparent transactions and settlements between participants. Through smart contracts, not only can cumbersome paper processing be eliminated, but the number and involvement of intermediaries can also be reduced, resulting in lower transaction costs and shorter transaction cycles.

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25. Shi Qin. (2023). Research on the application of blockchain technology in the field of digital trade - based on the perspective of the whole process of international trade. *China Business Journal* (01), 45-49. doi:10.19699/j.cnki.issn2096-0298.2023.01.045.

Blockchain also brings new business models and market opportunities for international trade. Taking decentralised finance (DeFi) as an example, blockchain technology enables investors across the globe to conduct cross-border transactions and investments directly, bypassing the restrictions of traditional financial institutions. This innovative financial model creates more opportunities for small and medium-sized enterprises (SMEs) to participate in global trade and contributes to the development of the global economy.

In international trade, blockchain can also improve supply chain sustainability and quality assurance. Through blockchain technology, the origin and transfer records of products can be traced and verified, ensuring compliance and quality reliability. This is important for promoting sustainable development and the provision of quality products, while also enhancing consumer trust and satisfaction with products.

Currently, the process of global trade is becoming increasingly computerized and faster. The use of blockchain and digital currency technology in international trade is already a clear trend. If a higher level of integration can be achieved, the security systems for the logistics, transfer, and transactional information of international trade will be greatly enhanced<sup>26</sup>.

## 6. Conclusion

The analysis above leads to the conclusion that blockchain technology holds great potential and opportunities in the international trade field. The decentralised and tamper-proof nature of this technology considerably improves supply chain management by enhancing transparency, trust, and traceability. The application of blockchain technology has resulted in supply chain tracking and verification becoming more efficient and reliable while mitigating the risks of information asymmetry and fraud, and further improving the security and sustainability of trade.

Furthermore, blockchain technology has the ability to simplify and automate international trade processes, leading to real-time, transparent transactions and settlements through the usage of smart contracts. The above leads to lower costs, reduced intermediate links, faster transaction cycles, and increased efficiency. Blockchain technology offers more opportunities for small and medium-sized enterprises (SMEs) to engage in global trade, thus contributing to economic development and inclusive growth.

Nevertheless, the application of blockchain technology in international trade encounters several challenges and obstacles. More attention needs to be given to the absence of technical standards, scalability problems, privacy, and data security. Furthermore, legal and regulatory frameworks must be established to guarantee compliance and consumer protection.

To address these challenges, future research and practical applications should prioritize developing and promoting technical standards, improving the scalability and performance of blockchain, and enhancing privacy protection and data security. Moreover, it is essential to actively encourage international cooperation and reform of the legal and regulatory framework to facilitate the implementation of blockchain technology.

## References

- [1] Gad, A. G., Mosa, D. T., Abualigah, L., & Abohany, A. A. (2022). Emerging trends in blockchain technology and applications: A review and outlook. *Journal of King Saud University-Computer and Information Sciences*, 34(9), 6719-6742.
- [2] Böhmecke-Schwafert, M. (2024). The role of blockchain for trade in global value chains: A systematic literature review and guidance for future research. *Telecommunications Policy*, 102835.
- [3] Deepa, N., Pham, Q. V., Nguyen, D. C., Bhattacharya, S., Prabadevi, B., Gadekallu, T. R., ... & Pathirana, P. N. (2022). A survey on blockchain for big data: Approaches, opportunities, and future directions. *Future Generation*

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26. Liu, Yuhong & Chang, Jianing. (2021). Application of blockchain and digital currency in international trade. *Journal of Economic Research* (29), 108-110.

- Computer Systems, 131, 209-226.
- [4] Jiang Yishe. (2021). The Impact of Big Data Analysis Capability and Supply Chain Visibility on Mass Customisation Capability (Master's thesis, Harbin Institute of Technology).  
<https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202201&filename=1021903761.nh>
- [5] Dubey, R., Gunasekaran, A., Childe, S. J., et al. (2020). Upstream supply chain visibility and complexity effect on focal company's sustainable performance: Indian manufacturers' perspective. *Annals of Operations Research*, 290(1-2), 343-367.
- [6] Zhang, L. & Zhang, Z. A.. (2023). Research on legal risk control of blockchain technology applied in international trade. *Business Economics* (03), 100-103.  
doi:10.19905/j.cnki.syjj1982.2023.03.029.
- [7] Shi Qin. (2023). Research on the application of blockchain technology in the field of digital trade - based on the perspective of the whole process of international trade. *China Business Journal* (01), 45-49.  
doi:10.19699/j.cnki.issn2096-0298.2023.01.045.
- [8] Liu, Yuhong & Chang, Jianing. (2021). Application of blockchain and digital currency in international trade. *Journal of Economic Research* (29), 108-110.