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Blockchain Implementation in International Trade: A Theoretical and Empirical Analysis Using VOSviewer

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ABSTRACT

Transparency, Security, efficiency; those three words can be assimilated to the fundamentals of a foreign operations, and that parties are all always in the obligation to optimise the process to fulfill their needs, this technology was reputed one of the valuable assets that appeared in the recent years was the blockchain technology gaining popularity in the financial world that we can emerge to the international trade offering a lot benefits. This research gives introduction about an innovative approach aimed at overcoming the limitations associated with reliance on stakeholders in international trade transactions. and it aims to add a valued solutions and to enhance the important gap existing research both conceptual foundations and practical insights . Moreover, we provide in our empirical part a study by VOSviewer, that it is enhance by The Methodi Ordinatio technique has been employed in this study to identify the most relevant studies in the field of international trade, guiding the research process through the selection, analysis, and systematic review of 42 articles retrieved from the Scopus database, all related to foreign trade transactions., to furnish a deeper perspective on the working of the mechanism By analyzing and identifying the highlight of the significant impact of blockchain on various trade-related processes.

INTRODUCTION

In today's rapidly changing world, technological advancements are reshaping the way we live and conduct business. Among these innovations, blockchain technology stands out for its immense potential to transform foreign trade. By leveraging its unique features, blockchain offers several advantages that can address the challenges faced by businesses engaged in international transactions.

Traditional foreign trade processes have long been plagued by high costs, complex procedures, and numerous intermediaries (Barelier *et al.*, 2003). However, blockchain's decentralized and transparent nature provides a solution. It allows for direct peer-to-peer interactions between buyers and sellers, eliminating the need for intermediaries like banks and clearinghouses. This not only reduces transaction costs but also accelerates the speed of trade, enabling businesses to operate more efficiently and compete effectively in the global marketplace.

One of the key benefits of blockchain in foreign trade lies in its enhanced security and trust. Through its immutable and tamper-resistant records, blockchain ensures the integrity of trade data, reducing the risk of fraud and fostering trust among trade partners (Popa, 2008). The transparency offered by blockchain facilitates secure transactions, minimizing disputes and expediting customs clearance procedures.

Moreover, blockchain technology enhances traceability and accountability in foreign trade. Every transaction recorded on the blockchain allows for accurate tracking of goods from manufacturers to final consumers (Hackius & Petersen, 2017). This traceability feature improves

supply chain management, enabling better control over product origins, quality assurance, and compliance with regulatory standards. By providing a single source of truth, blockchain ensures that all stakeholders have access to reliable and verifiable information, enhancing transparency and reducing uncertainties.

In addition, blockchain technology improves the efficiency of cross-border payments, a vital aspect of foreign trade (Xiao *et al.*, 2021). Traditional cross-border payments are often slow and costly due to multiple intermediaries involved. However, blockchain-based cryptocurrencies and smart contracts enable near real-time settlements, eliminating intermediaries and reducing transaction costs. This increased efficiency improves liquidity and expedites foreign trade transactions, empowering businesses with greater agility and financial flexibility.

The significance of this study lies in its exploration of blockchain's transformative potential in foreign trade and international transactions. By addressing key research questions, the study contributes to advancing knowledge and bridging the gap between theory and practice (Norris & Oppenheim, 2007). The findings have the potential to drive economic growth and enhance operational efficiency in international trade, as blockchain's capabilities in cost reduction, streamlined processes, improved transparency, and enhanced trust pave the way for smoother and more efficient transactions. Ultimately, this research provides valuable insights for stakeholders, helping them understand the benefits and challenges associated with implementing blockchain in the international sector and fostering a deeper understanding of blockchain's role in the global trade ecosystem.

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The article commences with a comprehensive literature review, divided into two main sections (Bartodziej, 2017). The first section explores blockchain technology, providing a thorough understanding of its concepts, features, and potential applications. The second section focuses on the application of blockchain in international trade, examining its transformative potential in areas such as supply chain management, cross-border payments, and trade finance. To enhance analysis and visualization, VOSviewer, a powerful bibliometric analysis tool, is employed (Pagani *et al.*, 2015). This software facilitates the identification of trends, patterns, and connections within the literature, enabling a structured examination of the research landscape. Subsequently, the article engages in a discussion section that critically analyzes and interprets the findings from the literature review and bibliometric analysis. This discussion provides insights into the current research landscape, identifies gaps and areas for future exploration, and offers practical implications for researchers, practitioners, and policymakers in the field of blockchain and international trade. Lastly, the article concludes by summarizing the key findings, emphasizing the significance of blockchain technology in revolutionizing international trade, and suggesting avenues for future research.

LITERATURE REVIEW

Blockchain Technology

The Blockchain Mechanism

Blockchain technology has seen a significant rise in prominence in recent years even a huge impact in the process of international trade (Vincent *et al.*, 2020) and is now regarded as one of the most transformative innovations of the 21st century (Kimani *et al.*, 2020). It is at the root confidentiality, security and integrity specificity of transactions in network environments (Kotamraju *et al.*, 2021), This allows it to act as a remedy to current problems in many respects such as industry and supply chains (Ali *et al.*, 2021).

To assure security that represent as one of the obstacles that we can find between entities because a lot of reasons, on top of them we can locate the hackers so with the blockchain , the new revolution we can ascertain a redress for this problem, in the absence of any notion of neglecting the hashing and the encryption that would reinforce it (kotamraju *et al.*, 2021).

Ever since Bitcoin first entered the financial landscape, efforts and a lot of studies have been made to have a distinctin between those two terms: blockchain and crypto-currencies. Tapscott (2016) has demonstrate that blockchain has more potential and applications beyond the financial realm.

A new digital ledger system that can record all types of value, such as deeds, titles, and intellectual property rights. This digital revolution of “Peer-to-Peer” is defined by Leloup (2014), an expert in corporate finance and blockchain, as being a transactional database similar to a ledger where transactions are recorded in a block

following subsequent transactions without being able to erase the latest ones.

The computer scientists who developed this technology sought to circumvent the issue of non-transparency in the financial system by attempting to displace the central authority of trust (Moukafi & Dafir, 2025).

According to Huang *et al.* (2019), the database consists of numerous data entries corresponding to various transactions.

A database is now referred to as a “ledger” because of the financial industry’s use of blockchain technology. A computer file or summing register that automatically logs all activities related to economic transactions in nodes. Ledger data exploration is the process of connecting all the nodes in a blockchain system (Huang *et al.*, 2019). Data is verified via blockchain technology, which employs a network of connected blocks.

Synchronization uses a reliable consensus mechanism that synchronizes any type of change belonging to an exchange. A consensus technique is used in a distributed blockchain network to establish a single source of truth among peers. On the blockchain, this protocol acts as an algorithm to verify transactions and sign blocks. The consensus method ultimately determines which blocks are included in the chain of the transaction (Bashir, I.2022). Consensus protocols’ main goal is to provide a consistent and unambiguous hierarchy for transactions and blocks. Bashir (2022) assure that this guarantees the blockchain’s consistency and integrity, even across geographically separated nodes.

The consensus protocol enables parties with no inherent mutual confidence to cooperate without the requirement for a trusted intermediary by deciding the rules for updating the register. This decentralized strategy promotes a trustworthy and safe environment for network communication (Magbitang *et al.*, 2023).

More specifically, in a context relating to finance, Vamparys (2018) mentions that blockchain technology enables better portfolio management and many more benefits, which he presents as follows:

- Cost optimization;
- Task automation;
- Speed of execution;
- Preservation of essential elements;
- Data security and confidentiality;
- Transparency of operations.

Furthermore, Verdier (2018) demonstrates these same advantages in the context of the finance function, adding better data organization as well as the way to ensure the performance all the tasks that are usually carried out by a trusted third party, including data verification, collateral registration, payments as well as exchange approval...

The modification of data enables a trusted digital system where information can be safely stored and shared without the risk of being altered so we see that blockchain can also be deployed using other advanced technologies namely IOT, identity management, and supply chain systems (Feng *et al.*, 2019).

Types of Blockchain

When a company is looking to develop a blockchain solution, we need to know which type of blockchain is most appropriate to their situation. According to Solat *et al.* (2021), blockchain can be classified as either permissionless (public blockchain), permissioned (private blockchain), or both (hybrid blockchain).

Public Blockchain

The public blockchain, sometimes referred to as a permissionless blockchain, is an unrestricted, decentralized system that anybody may use. Any entity may join this kind of blockchain as a node and aid in the validation of online transactions. Every piece of information in a transaction is properly checked thanks to the consensus technique utilized. Greater inclusion and transparency inside the network are made possible by this openness (Viriyasitavat & Hoonsoon, 2019). However, it must be emphasized that transactions in this type of blockchain are always anonymous, taking the name of a pseudonym, since actors are distinguished by their cryptographic addresses (Solat *et al.*, 2021). Ripple, Cardano and Dogecoin are good examples of this.

Private Blockchain

Not only the presence of the public blockchain, we are in the existence of another type also the private blockchain, which we can find known as the blockchain with permission (Moukafi & Dafr, 2025).

Without neglecting to say that among the reasons for the evolution of the private blockchain is to remedy the flaws found within the public blockchain notably such as data reversibility, data confidentiality, transaction volume scalability and system responsiveness (Hamida *et al.*, 2017). The components suggest that this kind of blockchain is distinguished by a controlled access network, according to (Solat *et al.*, 2021). It is frequently used in organizations where joining requires permission. R3 Corda is a private blockchain platform that is designed for financial institutions within a carefully chosen group of participants. It is built on trust and collaboration, and it helps businesses to share data securely and efficiently. R3 Corda also streamlines identity and asset management, making it easier for businesses to work together.

Hybrid Blockchain

In light of the benefits and drawbacks of the first two types of blockchain, there is a third type that combines the advantages of public and private blockchains, in particular the hybrid blockchain, also known as the interoperable blockchain. This type is distinguished by its interconnectivity, asset portability, and scalability, which allows communication between multiple blockchains.

The benefits of hybrid blockchains are numerous including the ability to apply use-case-specific rules and technologies, including zero-knowledge proofs, as well as increased confidentiality, better transaction throughput, and cheaper costs (Geroni, 2021).

These technologies allow for the division or even complete privacy of information, which is frequently necessary for many corporate processes. Notable examples include Dragonchain, Wanchain, Cosmos (Chauhan *et al.*, 2018).

Consortium Blockchain

A consortium blockchain combines features of both private and public blockchains. It's managed by a limited group of trusted participants, meaning only selected members can approve or record transactions, while the general public may still be able to view them. This setup ensures greater control and security within a specific network. A good example of this type is Hyperledger Fabric (Xiao *et al.*, 2021).

Roles of Blockchain

The many responsibilities and capacities offered by blockchain innovation can greatly improve the effectiveness of cross-border commercial transactions. One of its main benefits is that it offers real-time notifications in a very effective way. It also makes it simple to visualize how paperwork, contracts, and agreements move. Additionally, the implementation of smart contracts on the blockchain enables decentralized contract development and execution as well as real-time document and agreement verification. Additionally, blockchain establishes digital proof of ownership while ensuring the immutability and unforgeability of records of documents, conditions, and terms. This system encourages cooperative transaction and ownership transfer verification while streamlining administrative procedures. Additionally, blockchain gives users access to transaction logs, increasing transparency and dependability throughout the process (Ali *et al.*, 2021; Belu, 2019; Chang *et al.*, 2019, 2019; Sun *et al.*, 2019; Tapscott and Tapscott, 2016; Vincent *et al.*, 2020).

The specific characteristics of the innovation of blockchain stem from its hybrid nature. It is generally considered as one of the advanced technologies that can be supervised in two essential parts namely hardware and software technologies, for an example we can find distributed ledger technologies, licenses and even smart contract with P2P softwares (Lu, 2019).

The transparency of blockchain technology is one of its key benefits (Morgan *et al.*, 2018). With the help of blockchain's distinctive and potent powers, this transparency is made possible. Blockchain differs from conventional centralized systems in that each user (node) is required to maintain a copy of the data, ensuring redundancy and security (Lu, 2019). All transactions and pertinent data are shared throughout the whole network, maintaining high levels of transparency and giving all participants access to data in real time. In contrast, data is often held in a single location and transactions are typically validated by trusted intermediaries in traditional centralized database systems, introducing a centralized point of control and potential weaknesses.

This reliance on central servers not only incurs additional costs but also raises significant concerns regarding

system performance. Once data has been recorded in the distributed ledger of the blockchain, it is guaranteed to remain unmodified (Beck *et al.*, 2018). This ensures a high level of security and accuracy because transactions and data saved on the blockchain cannot be altered. As all network members have access to the same verified information, research suggests that this feature considerably lowers transactional insecurity and uncertainty (Ali *et al.*, 2020). Blockchain offers a number of other capabilities that improve transaction processes in addition to its immutability. Real-time notifications and verifications are made possible through the use of smart contracts, digital signatures, and multiple signatures. With the use of this technology, transaction results and performance may be measured effectively and reliably (Moukafi & Dafir, 2025). Blockchain improves efficiency and lowers costs by removing the need for middlemen like banks. The entire process can be streamlined by suppliers independently verifying transactions in virtually real-time (Koetsier, 2019).

Blockchain is recognized as a major technological breakthrough in the digital transformation of both physical and digital asset ownership (Ali *et al.*, 2020). In addition to providing a secure and tamper-resistant audit trail, it is also seen as a flexible platform for managing both assets and contracts (Lindman *et al.*, 2017; Mattila, 2016). When dealing with purely digital assets, a public registry allows for secure tracking of ownership, opening up a wide range of new possibilities (Athey *et al.*, 2016).

Smart Contracts

Smart contracts, a crucial component of blockchain that improves peer-to-peer commercial transactions, are introduced (Roriz & Pereira, 2019). According to Eenmaa-Dimitrieva and Schmidt-Kessen (2019), smart contracts are simply agreements that have been established in code and are intended to be carried out automatically in a blockchain context. Szabo (2018) asserts that a contract is a group of commitments established during an agreement, which is the conventional method of formalizing relationships, particularly in business with some objectives such as satisfying contractual conditions (e.g., payment of due dates, privileges, confidentiality, even performance); by minimizing the possibility of exceptions, whether they are malicious or accidental in nature.

Smart contracts, which use protocols to ensure that everyone maintains their agreements, bring the central notion into the digital age. Digitally specified promises are made. Not simply for business-to-business contracts and partnerships, smart contracts can be utilized in a wide range of agreements. Smart contracts don't have a "smart" component; however they are not "Smart" there is no cognitive component or artificial intelligence indeed they involve an automatic execution of a predefined task when specific conditions are met. the obligations of these Contracts do not reflect a contract in the legal sense.

Szabo (1997) considers these contracts to be intelligent

because they are much more functional than their inanimate paper-based ancestors and even he has described smart contracts as "protocols within which parties execute". Therefore, when an event or transaction occurs, there are rules that indicate how the data should be processed in order to achieve the right result. This can be achieved by transforming smart contracts into computer code with agreements and clauses that are embedded as lines of program code.

Cryptocurrency-based automated financial applications now have more options thanks to the development of smart contracts and their connections to decentralized autonomous organizations, decentralized applications, smart tokens, and smart properties (Di Francesco Maesa & Mori, 2020). Computer protocols known as "smart contracts" are essentially used to verify, facilitate, or enforce the terms and conditions of a pre-defined contract in a digital format. Despite the fact that the theory behind smart contracts dates back more than 20 years, recent developments in the bitcoin and blockchain industries have reignited interest in their potential (Werbach & Cornell, 2017).

Smart contracts' capacity to facilitate reliable transactions without the use of middlemen is what makes them so attractive. These transactions offer a high level of security because they are transparent and irreversible. It's important to keep in mind that establishing smart contracts can be challenging and requires significant thought, particularly when they operate on a blockchain (De Graaf, 2019).

Programmable contracts were developed to facilitate the automation of transactions so that parties could agree on the result of a particular event without the need for a central authority (Roriz & Pereira, 2019). A smart contract utilizes the immutable and trustless characteristics of blockchain technology to provide peer-to-peer agreements that are self-enforcing and managed through computer code (Brennan & Lunn, 2016). To unleash the true power of the smart contracts it will be more significant to talk about the internet of things furthermore Smart contracts, which are self-executing contracts that activate when predetermined circumstances are satisfied, have the potential to be used with blockchain technology. However, smart contracts are frequently used in conjunction with other technologies, particularly the Internet of Things (IoT).

The Internet of Things (IoT) is a game-changing concept that describes a massive network of sentient devices capable of self-organization, data sharing, and responding to environmental changes. It is a significant improvement in Information and Communication Technologies, allowing for worldwide connectivity and effective management of sensors, devices, users, and information (Madakam, 2015). While it is simple to imagine utilizing IoT to follow products such as cola cans or cereal boxes from production to consumption sites, there is a growing trend to incorporate nearly any physical object imaginable into the IoT.

The Internet of Things consists of networks of

interconnected sensors and “intelligent” gadgets that can broadcast and receive data via the Internet. Smart contracts can use oracles to initiate specified actions based on data supplied by IoT.

An oracle is a digital mechanism that allows intelligent contracts to access external data, acting as a bridge between blockchains and the outside world.

Material oracles are integrated into physical systems such as RFID readers, providing real-time data to intelligent contracts. In the meanwhile, Oracle software retrieves data in real time from other programs and online application programming interfaces (API), such as market prices, flight status, and weather data (Khan *et al.*, 2021)

The information derived by oracles is then integrated into an intelligent contract via a data flow provided by third-party service providers, based on the requirements set in the intelligent contract.

Smart contracts can transform the way peer-to-peer business transactions are carried out due to a set of characteristics that not only set them apart from conventional contracts but also enable them to generate value and develop new business models. The characteristics are: i) being able to be stored and executed on various computers in a decentralized network, hence not requiring intermediaries; ii) independent execution of “if-then” rules, thereby ensuring that contractual agreements are executed automatically; iii) utilization of consensus-based validation of transactions; and iv) data storage in an unalterable public ledger. This tamper-evident ledger is a single point of reference and offers transparency (De Graaf, 2019). Furthermore, smart contracts are able to establish trust in the absence of conventional trust processes, commonly known as “trustless contractual environments” (Eenmaa-Dimitrieva & Schmidt-Kessen, 2019).

Application of the Blockchain over International Trade

Logistics

In the world of international exportation and importations, we can find a lot of operations that have the nature of logistics. The activities of packing, loading, and pre-carriage of goods are essential to ensure the safe and efficient transportation of goods. Goods are packed and loaded into containers or other protective materials at the factory or warehouse of departure. They are then moved to the port or airport of shipment by wagon or another vehicle. These activities are performed by a team of trained professionals who ensure that the goods are properly packed and loaded to withstand the rigors of transportation, even international transport that it is the most important phase of the whole process, customs formalities for export and import, main carriage, insurance in international traffic, post-carriage and unloading of goods (Popa 2018).

Responsibility for logistics operations lies with the exporter or importer, depending on the Incoterms clause

adopted by the parties, It's crucial to draw attention to the distinctions between the two main parties involved in international commercial terms, namely the vendors and the consumers. This entails being aware of each party's responsibilities, risks, and financial obligations (Moukafi & Dafir, 2025). We may assure easier transactions and improved collaboration between the two parties in international trade by outlining these issues in unambiguous terms, if not the way in which they have defined mutual responsibilities, the applicable legislation and the costs that each entity must bear (Vogt & Davis, 2020).

For the suppliers, any failure in the logistics system means added cost and can damage the reputation of the organization (Popa, 2008). In the contemporary globalized economy, logistics and their costs have emerged as major determinants of competitive advantage and modernization, as well as a major determinant of environmental sustainability (Belu, 2008). The emergence of the recent fourth industrial revolution has introduced a novel paradigm toward the structuring and management of the entire life cycle of a product with a thrust toward Cyber-Physical System integration. This system is based on joining sensor networks with on-board computing to monitor and assure the placement of physical materials entering the production mechanism and logistics process, and the potential of blockchain for supply chain management is being exploited in conjunction with complementary technologies, including the Internet of Things (IoT) and oracles.

The term “Internet of Things” describes gadgets that are linked to regional (Wi-Fi, Bluetooth) or international (GSM, GPRS) networks for remote monitoring and control or specific job execution. Production facilities, structures, or intelligent goods are examples of interconnected things with intelligence (Bartodziej, 2017). The following would happen if blockchain technology were to be implemented in logistical processes related to import and export operations (Hackius and Petersen, 2017):

- Flexible handling of the transaction's paperwork is necessary for both the stages of receiving the products and paying for them as well as for taking ownership of the acquired items (Moukafi & Dafir, 2025).

Supply Chain Optimization and Cost Reduction

Through the Internet of Things (IoT), document management and shipment tracking become more efficient. Blockchain allows for the decentralized storage of large volumes of data, enabling rapid processing and timely access to information (Dobrovnik *et al.*, 2018).

Enhanced Security

Because the necessary computations are performed by a number of machines in a decentralized way, the information recorded in the blocks is unalterable and immutable, meaning that it is essentially impossible for anybody to edit it.

Transparency

The use of blockchain technology ensures that products are traceable right from their starting point to their end user, thus increasing transparency at each step. Every stage of the lifecycle of the product—ranging from manufacturing through packaging to delivery—is observable (Williams *et al.*, 2015).

Visibility is an essential aspect in supply chains, and it requires that every element of the Cyber-Physical System (CPS) receives accurate information about both the upstream and downstream counterparts to make informed and effective decisions. Visibility in supply chains enables real-time tracking of products from the manufacturer to their final destination, including all the intermediary stages (Shih *et al.*, 2019). It enhances operational efficiency by providing access to reliable, real-time information from trusted sources (Miraz *et al.*, 2020).

Payment and Finance

Letter of credit is one of the most popular payment methods in international trade, only second to open account-based payments. Yet, within the European Union, especially for intra-community transactions, its application is relatively rare. Perhaps this is because handling payments via letters of credit is time-consuming and expensive. Quite frequently, merchandise reaches destinations prior to the final confirmation of required documents by intermediaries like bank officials (Ganne, 2018).

Often, the goods arrive at their destination while the documents are still being checked by bank employees according to the banks who has interaction between the supplier and the customers, their banks have 5 days in max each to assure the consistency of the documents.

In open account payment, the exporter assumes a very high level of risk since they deliver the goods and hope for the importer to meet their financial commitment (Moukafi & Dafir, 2025).

The traditional financing and payment process via letter of credit is also complex with multiple parties, large documentation, and expensive.

For example, according to a study by the Boston Consulting Group, there a lot entities are involved in a single financing operation over an international trade transaction, involving a lot of documents and a cumbersome financing management process.

After a survey updated by BCG, they have found that 99% interchange between all the contributors in a foreign trade operation that doesn't a create a notable value (Boston Consulting Group, 2017).

If we consider the fact that we can use a DLT such as blockchain technology in this type of payment method, we would make a remarkable change corresponding to reducing time of the operation, less paper work and even lower cost.

International operations, such as import and export, involve a wide range of tasks, including arranging shipments, handling customs duties, coordinating transportation, and managing finances. Effective financial

management is essential for successful international trade, so businesses need to have robust financial strategies in place.

Document Supervision

The primary role of documentation in the ownership transfer of goods and payment guarantee across import-export operations demarcates the transactional framework operating in these operations. In the logistics stage, a variety of procedures is utilized to facilitate the sale and physical movement of goods from the buyer to the seller. Each procedure demands certain commercial documents, for example, the commercial invoice (that confirms the sale), the packing list (that enumerates the cargo contents), and the transport document (that attests the goods have been loaded onto a transport means). At the financial phase, payment for the goods on contract is made, a process which also creates some basic documents, such as the bill of exchange and the letter of credit.

The document flow is key to the integration of the logistic and financial aspects; the delivery of goods is documented, and payment is completed by means of the exchange of such documents (Popa, 2008). Documents are classified into different types based on the issuer and function as we demonstrate in this figure.

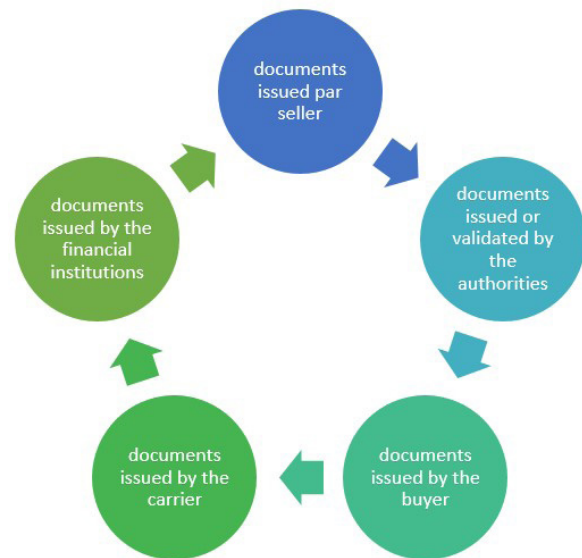


Figure 1: Document supervision process

Source: Popa and Belu (2018)

There are many types of documents used in international trade, each serving a particular purpose in the transaction process.

Documents issued or attested by competent authorities: Documents provided by government authorities responsible for regulating foreign trade, like ministries, customs authorities, diplomatic missions, consulates, and chambers of commerce and industry, are included in this category.

Documents Prepared by the Exporter

The exporter prepares some of the most important documents, such as pro-forma invoices, commercial invoices, and transport documents. Based on the delivery terms, the exporter might also prepare documents for storage of goods, shipping, entering into insurance contracts, and inspection. The exporter's obligation under the Incoterm EXW is to make the goods ready at their own premises for delivery.

Documents Prepared by the Importer

Generally, the importer prepares various documents like the application for opening a letter of credit and the import customs declaration. Where delivery terms place the responsibility of transportation and insurance on the importer, they also prepare documents like the order note for bill of lading and the application for insurance. These documents are generally forwarded to a shipper who, on behalf of the importer, obtains the bill of lading and the insurance policy.

Transport documents are produced by the carrier. From among them, the bill of lading relates to sea and inland waterway transport and is important for conveying goods from the exporter to the importer while facilitating payment processing. In alternative modes of transport,

equivalent documents include the CIM consignment note in the case of rail transport, the air freight consignment note, and the CMR consignment note specified for road transport. While these documents perform roles similar to that of the bill of lading, they are defined as non-negotiable (Moukafi & Dafir, 2025).

Documents issued by banks: In the world of international business, the letter of credit is the most prestigious payment tool. Payments are normally made in terms of a predetermined set of documents, which include the commercial invoice, transportation document, insurance policy, and other commercial documents (Barelier *et al.*, 2003). Use of blockchain technology can revolutionize this process by digitalizing these significant documents, increasing transparency, and making cross-border trade transactions easier. Attempts at digitizing export transaction documents through the use of blockchain have already been made.

MATERIALS AND METHODS

To fulfill the aims of this research and gain deeper insights, we chose to carry out a bibliometric analysis reinforced by the Methodi Ordinatio. This is an approach based on two techniques, one structured and the other systematic, for a rigorous analysis of the existing literature.

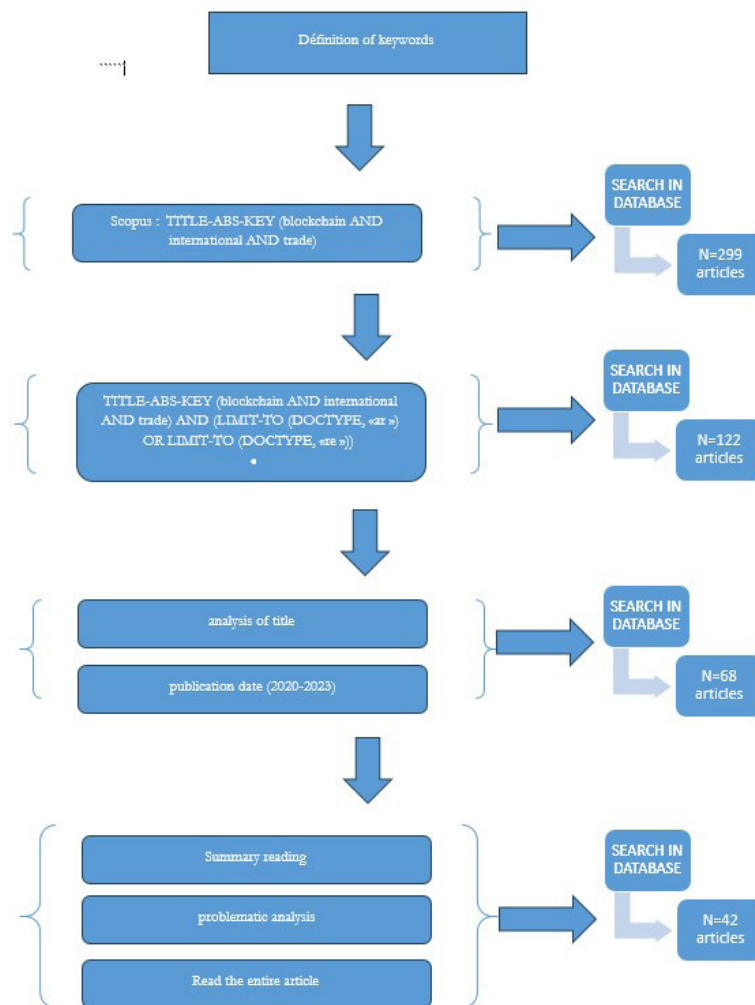


Figure 2: Methodological design

This tool helps researchers to create a sophisticated understanding of a particular scientific subject by providing them with a comprehensive overview of relevant perspective on the subject matter (Pagani *et al.*, 2015). To ensure the quality of article selection, a panel of expert evaluators was involved in the screening process, as illustrated in Figure 2.

The Scopus database, which was developed by Elsevier, was chosen for utilization in this research because it has a very wide multidisciplinary coverage of various academic fields like science, technology, medicine, social sciences, and humanities. The major reason for the utilization of this database was to find both research papers and review papers that correspond to the thematic focus and publication time frame of the research.

Scopus is identified as one of the two largest abstracts and bibliographic records databases of peer-reviewed scientific literature. Its rigorous editorial criteria and international standing ensure that it is a trustworthy authority for upholding academic standards and for tracking the development of scientific thought in most areas, especially in applied and technological research (Falagas *et al.*, 2008). Additionally, as pointed out by Norris and Oppenheim (2007), Scopus gives strong bibliographic coverage across the social sciences and indexes a broad range of powerful journals.

In order to enhance our research collection process, we employed keywords, truncation, and Boolean operators, thus we were able to efficiently and precisely collect relevant literature. The process, therefore, resulted in 299 articles, as indicated in Figure 2.

We used a variety of filters and ranking techniques to identify the most relevant and impactful studies for a comprehensive analysis. We did this because it was not feasible to evaluate all of the papers obtained from the database search, given the limitations of time. These methods allowed us to put all our force on the most significant studies and by that we have initially comprised 299 articles.

Once the articles and reviews were identified, we proceeded with a filtering process, which allowed us to keep a total of 122 articles in a total. Going through this filtering process, we took great care to make sure that we didn't remove any relevant articles or reviews. This meticulous curation of the records ensures that we have a comprehensive dataset to conduct further analysis. As a result, our study can be more robust and meaningful, as it includes valuable information from a wide range of sources.

Afterward, after filtering by article title and publication date, 68 records were retained.

We used a systematic approach to filter out records that did not align with the topics of interest in our study. We evaluated each record based on three criteria: reading and analyzing the abstracts, assessing the relevance of the problems addressed, and thoroughly examining the selected articles. This meticulous process resulted in a final sample of 42 articles that precisely matched our research criteria.

In this context, the Methodi Ordinatio approach incorporates a specific equation designed to evaluate the relevance of each article by taking into account both the journal's impact factor (IF) and the number of citations received. This allows for a more objective assessment of an article's academic significance. Each selected article was then processed through the InOrdinatio coefficient formula to determine its relative importance within the literature:

$$\text{InOrdinatio} = (\text{IF} / 1000) + \alpha * [10 - (\text{Research Year} - \text{Publish Year}) + (\Sigma \text{Ci})]$$

In this equation, the Impact Factor (IF) of the journal, taken from the Journal Citation Reports (JCR), reflects the journal's scientific influence. α is a weight ranging from 1 to 10, chosen by the researcher to indicate the importance of each criterion within the context of the study. The Research Year refers to the year the research was conducted, while the Publish Year indicates when the article was actually released. Finally, the number of citations, represented as ΣCi , reflects how often the article has been cited. Together, these elements make up the InOrdinatio formula, which is designed to evaluate and rank the relevance and impact of each article in a balanced and thoughtful way. The InOrdinatio equation has the following dynamics:

(a) The impact factor is divided by 1000 (thousand), to normalize its value to the other criteria.

(b) Within the equation, there's a parameter denoted as " α ," which can take values from 1 to 10. A lower value of " α " suggests that the year criterion is of lesser importance to the researcher, whereas a higher value of " α " indicates that the year criterion holds more significance. This is particularly relevant in areas like technology transfer, where the number of recent publications plays a critical role.

In addition, the time frame should be broader in this case, given that it has been covered in the literature for more than a decade.

(c) This criterion is the raw number of citations found in the portfolio construction data.

Following data analysis, each article is assigned an InOrdinatio score, allowing for a hierarchy based on scientific relevance. Articles with a higher InOrdinatio value are more essential for possible inclusion in the research portfolio. After this ranking is created, the researcher is able to determine how many high-rank articles to explore in-depth, for example, the top 10, the top 50, or any number that aligns with the research priorities.

The methodology uses a coefficient to assess the relevance of the publication year. The researchers have assigned this coefficient a score from 1 to 10, with a higher score indicating a greater emphasis on searching for articles from more recent years.

By following this method, we settled the initial set of articles to 68, that require in-depth reading. After meticulous analysis, we finally retained 42 articles that fully met our selection criteria. These exclusion criteria

were rigorously applied and included the following steps in article analysis:

- (i) Complete portfolio = 299;
- (ii) Include just articles and reviews = $299 - 177 = 122$;
- (iii) Exclusion of articles by title and publication date = $122 - 54 = 68$;
- (iv) Exclusion of articles by abstract reading, problem analysis, and full article reading = $68 - 26 = 42$;

As a result, the final portfolio included 42 articles related to blockchain and its impact on international trade. A total of 42 high-impact articles were selected for evaluation and discussed in the results section. All references were organized and managed using the Mendeley reference management tool.

Visual co-occurrence maps (Figure 3) and bibliographic linkage maps (Figure 4) were generated using VOSviewer

software. These maps were constructed by taking into account article titles and abstracts, using VOSviewer's complete counting method.

Bibliographic data, citation data, authors of the unit of analysis, and bibliographic linkage were used as analysis criteria for map construction. The full-count method was applied to obtain a complete representation of the relationships between articles.

The articles are grouped together based on the number of related documents. This allows us to identify thematic clusters and similarities through bibliographic coupling. We then create visual maps that show the connections and relationships between publications. These maps make it easier to explore research areas, spot emerging trends, and identify significant articles within a specific field.

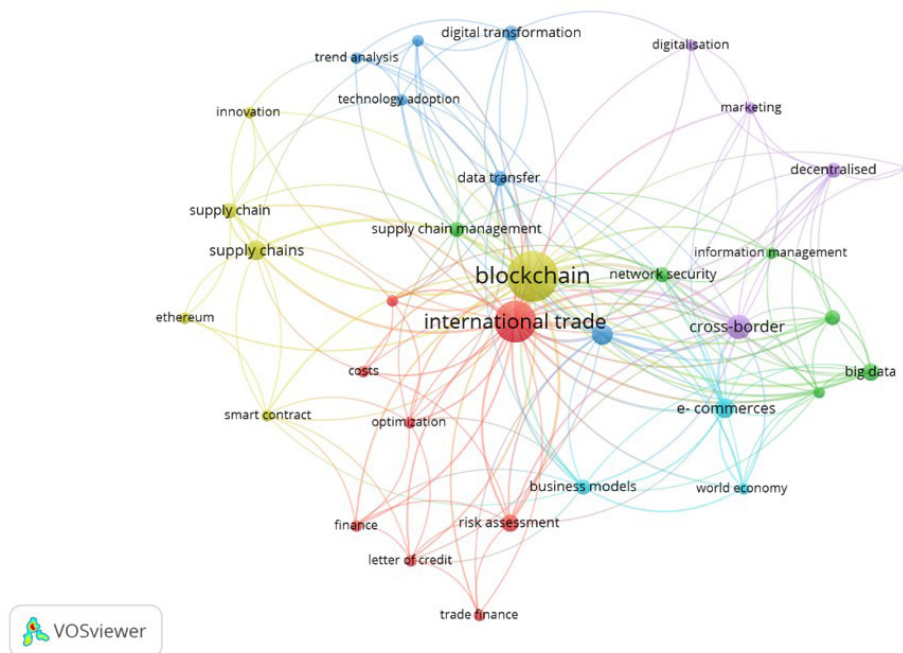


Figure 3: Co-occurrence of terms – final portfolio

The researchers used spreadsheets to calculate the InOrdinatio coefficient and analyze the results. They considered various characteristics to conduct a comprehensive analysis of the final portfolio that contain more than 40 significant articles, but not all articles were examined for every theme discussed. The researchers also explored and analyzed other aspects, such as the main themes covered, objectives and findings, suggestions for future research, key conclusions, and any additional analysis conducted by the authors.

While this research has its limitations, like any scientific study, the authors are confident that it makes a significant contribution to the existing literature on the subject. This is because no other research has been found that delves into the shared context of the topics discussed in this article. This highlights the originality and significance of this study within the research field.

The authors acknowledge that the Ordination method used in this study has some limitations. we point out that

the use of weighting factors or coefficients can introduce subjectivity into the analysis, and that the reliability of the results may be influenced by the data selection and the quality of bibliographic information used. we also mention that the scope of the method may be limited, which could potentially lead to an incomplete view of the research topic. However, we stress the need for researchers to fully understand the complexities of applying the method and remain open to various interpretations of the results. Ultimately, we suggest that the effectiveness of the method depends on how well it aligns with the specific research context.

In summary, this study used a rigorous methodology to analyze the results, taking into account a variety of characteristics and providing valuable insights into the themes addressed. The authors acknowledge the limitations of their research while hoping that this study will contribute to the advancement of knowledge in this field.

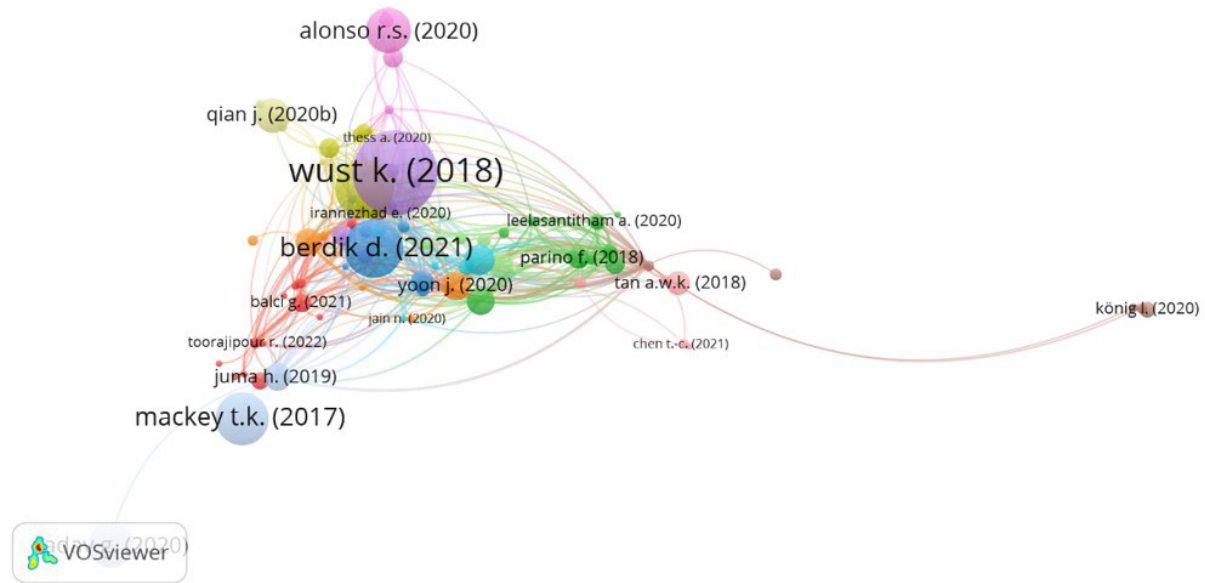


Figure 4: Authors and co-authors according to bibliography data

RESULTS AND DISCUSSION

In this segment, we draw attention to a compilation of articles contained in the final portfolio, consisting of multiple categories of research. Using the InOrdinatio index, we screened the articles according to the procedure stipulated by Pagani *et al.* (2015). Table 1 presents the compilation of articles contained in the portfolio. Observably, some journals have released studies on how blockchain influences worldwide commerce and affects the global supply chain.

Authors have listed the journals in the sample in accordance with the number of papers published on the subject, in descending order: International Trade Trends, Artificial Intelligence Research, Supply Chain Management, and Blockchain.

Interestingly, the trend through the years has been that the journals where most of these publications have appeared have changed.

The articles published on the evolution of blockchain are essential for understanding the changing behavior of international trade players such as customs, transport companies, and even governments concerning product prices and trust between suppliers and customers.

The analysis of the results was conducted based on the 42 articles selected through the Methodi Ordinatio, as outlined in the methodology section. For this phase, we created a visual map using textual data, focusing on the title and abstract of the articles. We then moved towards a deeper analysis by reading the full-text articles that had a significant word count.

For the visual map, a minimum of 5 occurrences per term was set. This resulted in a total of 33 key terms being identified, as shown in Figure 2. Additionally, a timeline was created to track the evolution of key themes based on the year of publication and to explore the relationships between these terms.

Several key terms were identified in the context of blockchain and its implications for international trade,

reflecting the broader impact and growing interest in this field.

Figure 2 presents the terms from a temporal perspective. On the basis of this visual representation, we can say that the terms “supply chain management,” “world economy,” “cross-border,” “decentralized,” “data transfer and “risk assessment” these are the subjects of the earliest high-impact studies. We can add those keywords such as “blockchain,” “international trade,” “network security,” “technology adoption,” These are more recent approaches, emerging only in the past few years.

Despite certain limits, we think our bibliometric study provides insightful information about the present status of blockchain and international commerce research. Based on the word count of abstracts and keywords, Figure 2 shows the findings and results obtained from the articles in our sample. According to this data, there is a notable concentration of research on how blockchain affects global trade and how it interacts with new technology. Notably, in 2020, we observed a trend toward studies exploring hardware technologies like blockchain, as well as topics related to sustainable global supply chains and the future involvement of governments and various actors in the regulatory landscape. Our research delves into the potential advantages of implementing blockchain-based solutions, such as enhanced transparency, improved traceability, and increased efficiency in global trade operations. These findings highlight the growing interest and potential benefits of blockchain technology in the context of international trade.

Based on data from many generations worldwide, the word count also demonstrates that since 2021, research has addressed concerns of trust, blockchain technology, environmental technology, and consumer trust and intention to trade globally. In addition, research was carried out into document management between the two countries and how different contributors play their own roles.

With experimentation, research changed in 2022, addressing issues like artificial intelligence in global trade. As a result, a number of studies have been conducted to examine how blockchain affects customers' and suppliers' intentions to buy items globally, as well as how they handle documents and make payments by air and sea. It seems that there has been a noticeable increase in the number of publications focused on the impact of blockchain on international trade. However, it's essential to be cautious about drawing definitive conclusions on trends because our research relies on bibliometric analysis. Nonetheless, this topic is gaining momentum and is emerging as a crucial area of research with significant potential for development in the coming years. Among the 42 articles in the final selection, the study by Abidi *et al.* (2021) stands out with the highest impact factor. Their research aims to enhance SCM and security through the integration of blockchain technology.

The study with the second-highest impact factor is by Balci and Surucu (2021), which explores the challenges of implementing blockchain in international containerized trade and identifies the key stakeholders involved. The study concludes that the primary obstacles to adoption are the lack of government regulations, insufficient support from major stakeholders, and limited knowledge of blockchain. These findings were derived using interpretive structural modeling and cross-impact matrix multiplication, which were applied to classification analyses (Figure 3).

Figure 4 shows the criteria used to construct the

bibliographic linkage map, namely:

- Bibliographic data;
- The full-count method;
- Bibliographic linkage at the analysis level. The total number of authors and co-authors was 299, with a total of 21 groups, i.e., authors who published the same study. WUSK *et al.* (2018) and BERDIK *et al.* (2021) incorporate authors who share similar research interests whose main research topics are: BLOKCKCHAIN; international trade facilitation; an the ability to improve transparency and traceability.

This research examines the use of blockchain technology in information systems and its potential impact on various fields. It highlights the growing interest in blockchain and its potential to transform global trade, supply chain management, logistics, customs procedures, and payment systems. The survey focuses on blockchain's ability to improve transparency and traceability in international trade by securely recording and verifying transactions. It also discusses the potential for streamlining business processes by automating tasks using smart contracts. In addition, the survey addresses the impact of the technology of blockchain in addressing trust and security concerns in international trade by ensuring data integrity and mitigating risk. Overall, the survey provides an overview of the potential benefits and challenges of implementing blockchain in information systems and highlights the need for further research and exploration in this area. (Wusk *et al.*, 2018; Berdik *et al.*, 2021).

Table 1: Result of the ordinatio analysis

No.	Title	Journal	Impact factor	Citations	Year	InOrdinatio
1	Blockchain-based secure information sharing for supply chain management: Optimization assisted data sanitization process	International Journal of Intelligent Systems	8,52	30	2021	342,0085
2	Blockchain adoption in the maritime supply chain: Examining barriers and salient stakeholders in containerized international trade	Transportation Research, Part E : Logistics and Transportation Review	11,42	21	2021	261,0114
3	Assessing citizens' behavior towards blockchain cryptocurrency adoption in the Mano River Union States: Mediation, moderation role of trust and ethical issues	Technology in Society	10,32	11	2022	160,0103
4	The digital tokenization of property rights, A comparative perspective	Computer Law and Security Review	2,96	14	2021	154,003
5	Blockchain in oil and gas industry: Applications, challenges, and future trends	Technology in Society	10,32	8	2022	119,0103
6	A Visualized Analysis of the Research Current Hotspots and Trends on Innovation Chain Based on the Knowledge Map	Sustainability	4,39	7	2022	112,0044
7	Blockchain-based information management for supply chain data-platforms	Applied Sciences	3,1	7	2021	105,0031

8	The potential of blockchain technology in the procurement of sustainable timber products	International Wood Products Journal	1,22	7	2021	105,0012
9	Uncovering the potential of blockchain in the agri-food supply chain: An interdisciplinary case study	Journal of Engineering and Technology Management - JET-M	5,64	3	2022	96,00564
10	Distributed ledger technology as a catalyst for open innovation adoption among small and medium-sized enterprises	Journal of High Technology Management Research	4,75	8	2021	96,00475
11	Blockchain in international e-government processes: Opportunities for recognition of foreign qualifications	Research in Globalization	7,58	5	2021	91,00758
12	Block by block: A blockchain-based peer-to-peer business transaction for international trade	Technological Forecasting and Social Change	13,64	8	2022	85,01364
13	Optimization Model of Cross-Border E-commerce Payment Security by Blockchain Finance	Wireless Communications and Mobile Computing	2,5	6	2021	84,0025
14	Cross-Border Capacity-Building for Port Ecosystems in Small and Medium-Sized Baltic Ports	Baltic Journal of European Studies	0,71	8	2021	80,00071
15	Governance in the era of Blockchain technology in Qatar: a roadmap and a manual for Trade Finance	Journal of Banking Regulation	2,2	4	2022	78,0022
16	Public value creation through voluntary business to government information sharing enabled by digital infrastructure innovations: a framework for analysis	Government Information Quarterly	9,37	1	2023	77,00937
17	Application of blockchain information technology in Şukük trade	Journal of Islamic Accounting and Business Research	2,57	4	2021	72,00257
18	Cross-Border E-Commerce Business Model Based on Big Data and Blockchain	Mobile Information Systems	2,41	1	2022	70,00241
19	The nature and sources of international variation in formal institutions related to initial coin offerings: preliminary findings and a research agenda	springer science and business media	7,59	1	2023	66,00759
20	Using NFTs and Blockchain for Traceability and Auctioning of Shipping Containers and Cargo in Maritime Industry	IEEE Access	4,82	2	2022	66,00482
21	Blockchain-Based Secure and Trusted Distributed International Trade Big Data Management System	Mobile Information Systems	2,41	2	2022	66,00241
22	Prospects of VAT Administration Improvement in Digitalized World: Analytical Review	Journal of Tax Reform	0,56	2	2022	55,00056
23	Distributed Ledger Technology (DLT): A Game Changer for MNEs in Emerging Markets	Journal of Risk and Financial Management	2,82	0	2022	54,00282
24	The Marketing of Cross-border E-commerce Enterprises in Foreign Trade Based on the Statistics of Mathematical Probability Theory	Applied Mathematics and Nonlinear Sciences	4,89	1	2022	50,00489
25	An Industrial Blockchain-Based Multi-Criteria Decision Framework for Global Freight Management in Agricultural Supply Chains	Mathematics	2,6	1	2022	50,0026

26	Application of a Blockchain Model in the Energy Market for Social Goodness: A Simulator to Generate Transactions	Periodica polytechnica Electrical engineering and computer science	1,16	0	2023	50,00116
27	Study on the Intention of Foreign Trade Driven by Cross-Border E-Commerce Based on Blockchain Technology	Security and Communication Networks	2,51	4	2021	48,00251
28	Pricing and redesign decisions for global supply chain of free trade port based on the complex system	AEJ - Alexandria Engineering Journal	8,34	0	2023	40,00834
29	Decentralized Global Copyright System Based on Consortium Blockchain With Proof of Authority	IEEE Access	4,82	0	2023	40,00482
30	A Survey on Blockchain for Information Systems Management and Security	Information Processing and Management	0,67	1	2021	40,00067
31	Blockchain for trade: When code needs law	AJIL Unbound	0,57	2	2021	40,00057
32	National Blockchain Laws as a Threat to Capital Markets Integration	Uniform Law Review	0,14	2	2021	40,00014
33	Impact of COVID 19 Pandemic and Big Data on China's International Trade: Challenges and Countermeasures	Frontiers in Public Health	5,18	0	2022	36,00518
34	Regulation of virtual currencies in the United Arab Emirates: accounting for the emerging public/private distinction	Development Studies Research	2,5	1	2021	36,0025
35	Analysis of Computer-Based Blockchain Technology in Cross-Border E-commerce Platforms	Mobile Information Systems	2,41	0	2022	36,00241
36	Research on Optimization of Steel Foreign Trade Financial Transaction Based on Blockchain Technology	Mobile Information Systems	2,41	0	2022	36,00241
37	Blockchain Won't Kill the Banks: Why Disintermediation Doesn't Work in International Trade Finance	Communications of the Association for Information Systems	2,24	1	2021	36,00224
38	The Impact of Digital Transformation in the Accounting System of Fuel and Energy Complex Enterprises (International Experience)	International Journal of Energy Economics and Policy	1,57	0	2022	36,00157
39	Blockchain-based smart contracts and conflict rules for business-to-business operations	Revista Electronica de Estudios Internacionales	0,14	2	2021	30,00014
40	Big Data Sharing Model and Key Mechanism of International Trade Based on Blockchain	International Transactions on Electrical Energy Systems	2,83	0	2022	27,00283
41	Research on Credit Algorithm of International Trade Enterprises Based on Blockchain	Mathematical Problems in Engineering	2,1	0	2022	27,0021
42	Towards a virtual water currency for industrial products using blockchain technology	Water Policy	1,87	0	2022	27,00187

CONCLUSION

To sum up, this article has conducted a thorough examination of how blockchain technology is utilized in the field of international trade. By meticulously reviewing existing literature, the study has revealed the core concepts, characteristics, and potential advantages of using blockchain to streamline different trade activities.

Additionally, the research has utilized VOSviewer, a powerful bibliometric analysis tool, to further enrich the analysis and visually display the connections and trends within the research field, offering valuable insights.

In this section, the researchers carefully analyzed the findings from the literature review and bibliometric analysis. This allowed for a deeper understanding of the

current state of research on blockchain and international trade. The study also identified gaps in knowledge and potential areas for future research, which can be beneficial for researchers, practitioners, and policymakers. The practical implications of the research contribute to advancing knowledge in this field and provide valuable guidance for future research.

This research highlights how blockchain technology could revolutionize international trade. Blockchain's ability to simplify processes, increase transparency, enhance security, and build trust could have a significant impact on supply chain management, cross-border payments, and trade finance. By adopting blockchain solutions, businesses and stakeholders in the international trade sector can improve their operations, navigate the complexities of the global market, and take advantage of exciting opportunities ahead.

This article concludes by emphasizing the importance of continued research and exploration in this area. By focusing on the identified gaps and delving deeper into the possibilities of blockchain in international trade, researchers can play a significant role in developing innovative solutions and strategies. This, in turn, can promote economic growth and sustainable trade practices. Blockchain technology has the potential to create a more efficient, secure, and inclusive global trade ecosystem.

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