How the use of blockchain technology affects trust in container management: A systematic review

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Abstract
Information exchange is vital in supply chain processes, including container management, which is the focus of this study. However, several technical and non-technical barriers hinder information sharing among the various organisations involved in this process. One major challenge is establishing trust among multiple entities before freely exchanging information. Sharing information is crucial in improving efficiency and service levels in container management. To overcome these obstacles, the use of blockchain technology (BCT) has been put forward as a promising solution to enhance information sharing in container management.

This study aimed to investigate the implications of implementing blockchain technology in container management from technical and non-technical perspectives. This study analysed current research and practical applications of blockchain technology in container management. Using the systematic literature review methodology, the study explored the advantages, difficulties, and outcomes of adopting blockchain in container management. This would provide a comprehensive understanding of how the use of blockchain technology in container management can address trust issues among organisations.

Blockchain trust

The Scopus and ScienceDirect databases were searched for relevant research on this topic. The findings reveal that transparency, traceability, accessibility, and information integrity were key factors influencing trust between organisations. An analysis of the literature demonstrated the significant impact of these factors on trust development among business partners in their operations. As an emerging technology, blockchain demonstrates its capacity to address these factors through its inherent attributes of tamper-proofing, traceability, decentralisation, and automation. These characteristics align with the essential prerequisites for establishing trust between organizations.

The findings of this study contribute to existing knowledge about how blockchain technology influences trust development in container management, as well as its effectiveness, limitations, and potential areas for improvement. For practitioners, the research provides guidance for implementing blockchain technology in container management processes. The findings of this study may help them make informed decisions and drive positive transformations in the field.

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Chapter 1 – Introduction

An efficient logistics and supply chain management are critical to support the rapid growth of e-commerce and international trade. However, while significant advances have been made in infrastructural elements such as smart terminals, supply chain processes have remained relatively stagnant over time (Islam et al., 2013). For example, there needs to be more innovation regarding key aspects of these processes, such as multi-entity collaboration, information sharing, and establishing a trusted transaction environment. The purpose of this study is to investigate one of these issues: how block chain technology (BCT) can increase the level of trust in the container supply chain environment. This study integrates existing knowledge to examine how the technical characteristics of BCT can address the existing trust challenges in container supply chains, to guide future researchers and practitioners.

The paper explores the functioning of BCT and its potential impact on business processes. It begins by elucidating the business process of container supply chains, providing readers with a comprehensive understanding of the research context and the need for BCT implementation. Subsequently, the background of BCT is outlined, detailing its distinctive features and successful applications in other industries. A systematic literature review (SLR) methodology is then employed to synthesise existing research on BCT technology's utilisation in logistics, trust, and supply chain domains.

The Findings section summarises the outcomes derived from the data collection process. In the discussion section, these research findings are contextualised within the business scenario of container supply chains to assess how BCT technology can contribute to trust development. The paper concludes by presenting recommendations for future researchers, aiming to inspire further exploration of BCT and supply chain trust within the academic community.

Chapter 2 – Background information

In this chapter, I discuss supply chains, container management, and BCT. I begin by providing a concise overview of supply chain and container management, digital information technology, and BCT, and then delve into its definitions and historical development from both technological and practical standpoints while integrating insights from previous studies.

2.1. Supply chain and container management

Supply chain management (SCM) is the process of planning, coordinating, and optimising the flow of goods, services, and information from the point of origin to the end of consumption (Mentzer et al., 2001). It involves managing activities that transform raw materials into finished products and deliver them to customers. Supply chain management is a crucial business process that helps organisations to operate efficiently, minimise costs, and maximise profitability. SCM involves the management of a complex network of suppliers, manufacturers, distributors, and retailers, as well as coordinating transportation, logistics, and inventory management activities. Effective supply chain management requires focusing on collaboration and communication, as well as using data analytics and technology to optimize operations and minimize risk (Wang et al., 2016). By managing their supply chains effectively, companies can improve customer service, reduce costs, increase profitability, and gain a competitive advantage in the marketplace (Mentzer et al., 2001).

Improving a supply chain means enhancing the three flows that make it up: material, information and finance (Andersen, 1999). Information and financial flows are initiated by the movement of materials, and material flows were substantially enhanced with the invention of containers in the 1950s by Malcolm McLean, an American entrepreneur (Tomlinson, 2009). This innovation established a uniform, modular, and secure means for transporting goods via various modes of transportation, such as ships, trains, and trucks. Today, shipping containers follow a set of global standards that specify the required size, durability, and design of containers, which range in size from 20 to 40 feet and include specialty containers tailored to specific cargo types. These include refrigerated containers for perishable items and flat-rack containers for bulky or oversized cargo. These standards guarantee the effortless transport and handling of containers across different forms of transportation. Container terminals act as transhipment points for cargo, allowing for the smooth transfer of containers from one mode of transportation to another. This enables goods to be transported across multiple regions and countries, facilitating global trade.

Below, the concept of the three flows of a supply chain is used to describe container management.

- **Material flow:**

In general, the flow of materials in a supply chain follows a series of steps: sourcing of raw materials, production and manufacturing of products, transportation and logistics, and distribution to retailers and end customers. Each step in this process is typically overseen by different stakeholders (Harrison et al., 2019).

Managing material flows across the supply chain is crucial for achieving success (Chin et al., 2004; Tummala et al., 2006). The success of managing material flows across the supply chain can be defined as efficiency cost reduction. The best SCM designs and strategies place the control of smooth material flow at their core, and material flow re-engineering can improve the effectiveness of the supply chain (Towill et al., 2000).

- **Information flow:**

Mentzer et al. (2001) state that the flow of information refers to the exchange of data and communication throughout the supply chain. It involves the sharing of information about inventory levels, production schedules, delivery times, and customer demand. This flow of information helps to ensure that all parties in the supply chain are on the same page and can make informed decisions.

Simatupang and Sridharan (2005) argues that information sharing is the capability to access private data in a partner's systems and track the progress of products as they move through each supply chain process. This activity involves the monitoring (data collection), processing, and transmission of customer data, end-to-end inventory status and locations, order status, cost-related data, and performance status. These authors have further argued that information sharing guarantees that partners in the supply chain are able to meet demand within reduced order cycle times based on the shared information (Lee & Whang, 2000; Yu et al., 2001). Stevenson and Spring (2007) noted that most organizations consider the flow of accurate and real-time information in the supply chain to be equally important as the physical movement of materials. Li et al. (2005) believed that the key to success in accurate and seamless information sharing depends on the source of data, which can be provided to both internal and external stakeholders. On the other hand, data integrity and security become the new challenge, Smith et al. (2007) noted that as the collaboration across supply chains increased, the protective barriers around assets and processes are reduced. The study further suggests that since IT threats affect supply chain risk, the benefits of collaboration enabled by IT integration must outweigh the increase in risk resulting from IT security threats.

- **Financial flow:**

The flow of capital refers to the movement of funds throughout the supply chain. Companies make payments to suppliers for raw materials and components, workers for their labour, and transportation and logistics providers for their services (Mentzer et al., 2001). Udin et al. (2006) considered that in order to manage the supply chain, it is crucial to have access to financial data and movement within organisations. The importance of financial performance lies in its reflection of the current financial state of organisations. Based on this information, top management makes decisions regarding the viability of their plans (Vickery et al., 2003).

Financial flows are also associated with risk, which is the potential for errors, inaccuracies, delays, or even fraud in the processes and systems that collect, process, store, and disseminate financial data across the supply chain (Collier & Sarkis, 2021). Such risks can compromise the integrity, availability, confidentiality, and reliability of financial information, undermining organisations' decision-making, planning, compliance, and performance. Effective risk management mechanisms and controls are crucial for organisations to mitigate the potential errors, inaccuracies, delays, and fraud associated with financial information in the supply chain, thereby safeguarding decision-making, planning, compliance, and overall performance. The common sources of risk include human errors, system failures, cyber threats, data breaches, regulatory non-compliance, and supply chain disruptions. Therefore, organisations need to implement robust risk management mechanisms and controls to mitigate, monitor, and respond to these risks effectively.

2.1.1. Stakeholder management in container transport

Stakeholder management is an essential aspect of any business or industry, including container transport. The stakeholders in container transport are the individuals, groups, or organisations that have an interest or influence in the industry's operations and outcomes. Most global goods transportation events today are containerised. To efficiently manage the flow of shipping containers, multiple stakeholders are involved across the supply chain: the shipping line, container suppliers (agencies), freight forwarder, terminals (e.g., ports, and container depots), government agencies (e.g., customs, port authorities, and transport ministries). Most of the stakeholders mentioned are not exclusively concerned with shipping containerised goods. They also oversee the other transportation forms of goods. For example, after unloading from the vessel, the goods from a container need to be divided into multiple pallets so that they can be transported by a barge or a truck. This necessitates clear communication between the freight forwarder, the goods owner, and the transport company. Consequently, exchanging operational information, such as status updates, customs clearance documents, and other related documents, can be long and complex. Thus, managing all the documents and information accurately, securely, and in an up-to-date manner is a significant challenge.

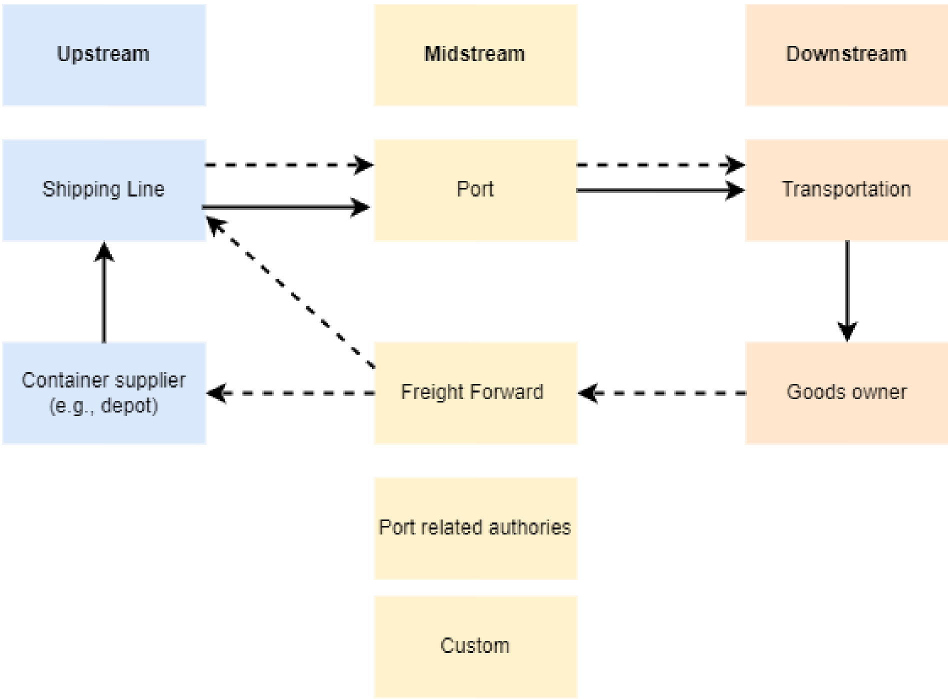

Figure 1: Container Management Process

Stakeholders in the container transport process can be found in different parts of the supply chain; thus, a trusted and closely connected transaction environment is required to effectively manage and satisfy the interests and business needs of these stakeholders (Patterson et al., 2003). This reflects the logic of resource dependence theory, which Denktas-Sakar and and Karatas-Cetin (2012) used to examine the relationship between a supply chain and its stakeholders. Resource dependence theory is based on the idea that organizations cannot generate all the resources they need to sustain themselves internally (Katz & Kahn, 1978). As a result, organisations must depend on one another for survival, leading to interactions and transactions with external entities that can provide necessary resources and services. These interactions are driven by each organisation's self-interest (Aldrich & Pfeffer, 1976).

Denktas-Sakar & Karatas-Cetin (2012) established the effect of supply chain stakeholders on the sustainability of a port by considering the proposition of interdependencies. As the main gateway for import and export containers, a port is in a critical position in the business process to connect the upstream and downstream of the chain. As a result, the development and deployment of information systems in the container transport process often operates with the terminal and the shipping lines as the core, and other relevant parties such as transport companies and downstream customers as a secondary priority (Banister et al., 1995). This results in organisations such as the port having an advantage in accessing external information from both upstream and downstream sources, allowing them to make informed decisions and take appropriate actions. Thus, this leads to the existence of a privilege in terms of data accessibility and availability.

2.1.2. Organisational trust in a supply chain

Trust is a critical element in any business relationship, and it plays a vital role in supply chain management. Organisational trust in a supply chain refers to the degree of confidence organizations have in their supply chain partners to fulfil their commitments, share information transparently, and collaborate effectively to achieve common goals (Meng et al., 2011).

Several factors influence an organisation's trust in other entities, including the level and quality of communication, consistency, transparency, integrity, and accountability (Laeequddin et al., 2010, 2012). Moreover, supply chain members should focus on lowering risk levels to establish trust, rather than attempting to establish trust as a means of reducing risk (Laeequddin et al., 2012). If members of a supply chain can maintain their risk levels within tolerable boundaries, trust can serve as a mechanism for managing risk; however, if risk levels surpass those limits, the issue of trust transforms into a matter of risk and security management.

It is widely believed that trust serves as a means of managing risks within the supply chain, as enhancing trust levels can lead to decreased risks. However, Collier and Sarkis (2021) believe that boundaries are unclear and permeable in supply chains today, which creates vulnerabilities where potential adversaries to access confidential data and cause disruptions. Therefore, placing excessive trust in a supply chain may heighten risk rather than reduce it. To further support this argument, Collier and Sarkis (2021) have proposed the "zero-trust supply chain", based on a concept from the field of cybersecurity. In essence, the zero-trust model operates on the principle of "never trust, always verify" and requires a comprehensive security infrastructure that includes advanced authentication and access controls, as well as continuous monitoring and analytics. By adopting a zero-trust philosophy, organizations can enhance their overall security posture and mitigate the risks of insider threats, external attacks, and other types of cyber threats.

2.1.3. Digital information technology (DIT) and managing trust in a supply chain

Digital information technology (DIT) refers to a broad range of technologies and tools that are used to create, process, store, and communicate digital data. These technologies include hardware and software systems, networks, databases, and various digital devices such as computers, smartphones, and tablets (Sambamurthy et al., 2003).

DIT has a significant impact on managing trust within supply chains. Today, DIT includes a range of innovative solutions for managing business operations, including technologies such as blockchain technology (BCT), artificial intelligence, the Internet of Things (IoT), and cloud computing. These innovations enhance supply chain visibility, security, and efficiency, and aid in the establishment and maintenance of trust between partners (Spahn, 2020). DIT's impact on trust in supply chains means that it facilitates the smooth flow of materials, information, and finances. How DIT does this is explained below.

- <u>Material flow</u>

In terms of material flows, DIT plays the role of the data input and capture nodes. Especially in container management, collecting accurate and reliable information is extremely important for smooth business operations. The sources of information can be divided into two aspects: shipping container information and information about business partners.

In this respect, the capture and input of data play a decisive role in the overall quality of the subsequent data flow. Data input mainly relies on a series of hardware (Zhong et al., 2016). In container management, automated container inspection is used to uncover the port-based inspection status of shipping containers (whether the box is rusty, whether the state of the box is suitable for the next use, etc.), and provide real-time updates of container use status and records (Bajauri et al., 2022; Orphan et al., 2009). Technologies such as RFID, AI, and IoT devices can be used for this purpose to resolve the issue of data capture. However, the current processes still require humans to verify the data and make operational decisions, which means that the possibility of mistaken data input and usage still exists; thus, the issue of data integrity and consistency is yet to be solved.

- <u>Information Flow</u>

Information flows among business partners are increasingly digitized, and this information must be integrated and verified. To effectively manage trust between stakeholders in the container supply chain process, it is necessary to adopt emerging technologies to address the challenges that arise.

Currently, relevant parties primarily exchange information through EDI, email, and API. EDI, being a standardized data exchange channel with a unified format and secure transmission through FTP and SFTP protocols, is typically deployed by core organizations such as larger shipping lines and ports (Anderson & Lanen, 2002). However, the deployment of EDI can be costly and inflexible (Klapita, 2021). In contrast, API is a cloud-based data exchange channel that supports two-way communication and one-to-many connections, allowing enterprises to use multiple terminals for the same process and achieve efficient data exchange (Ofoeda et al., 2019; Ong et al., 2015). On the other hand, e-mail, as a highly flexible and user-friendly information exchange channel, can reduce the cost of deployment and maintenance for enterprises (Huong Tran et al., 2016). As a result, e-mail plays a more significant role in small and medium-sized enterprises. The table below compares the two technologies on key attributes:

Features	**API (Application Programming Interface)**	**EDI (Electronic Data Interchange)**
Accessibility	**Cloud-based**	**File-based**
	A software interface enables access to data.	Between two parties, data is stored in a file on premise in various standard formats, including FTP (SFTP) and AS2
Interaction	**Two-way communication**	**One-way communication**
	Simultaneous sending and receiving of data enable any permitted connected system to read and write.	Only the sender can transmit information to the receiver, who is the only one with the ability to read and write.
Availability	**Real-time data exchange**	**Snapshot**
	Multiple systems can update data instantly and synchronously.	Data is updated and transmitted asynchronously, and the receiver perceives a snapshot of it at a certain point in time.
Updates	**Individual transactions**	**Batch data**
	Individual requests can handle each transaction, reducing the likelihood of errors impacting other requests.	Submitting updates to individual records together creates dependencies.
Setup	**One-to-Many connections**	**One-to-One connections**
	APIs can utilize a unified infrastructure to connect numerous partners, enabling connections to be established within a few days.	EDI typically connects individual partners, and the connection involving coding and testing, resulting in a setup time of several months per connection.

Table 1: Comparison of API and EDI for communication

Container management encompasses not only the information input and output of individual containers but also the overall flow of materials and subsequent information in business operations. As container information is crucial to terminals, shipping lines, and external business partners, ensuring the accuracy and timeliness of related information is the most significant challenge facing its information management system (Carbone & Martino, 2003). The process of importing containers at the terminal typically involves ship information, position information, import warehouse receipts, berthing window, loading, and unloading operations, and the weight and category of containers. Customs and port authorities may also conduct customs inspections, agricultural safety checks, and other related processes. Most of these processes are highly sensitive to time and accuracy, which poses challenges to the receiver's ability to verify the data's accuracy.

- Financial Flow

The major form of DIT used for managing supply chain financial flows is enterprise software, such as SAP, NetSuite (by Oracle) and others. Enterprise software's contribution to a company is to provide a centralized platform for managing their bills, payments, and risks. Many small and medium-sized organizations have implemented platforms or applications to digitize their billing and payment processes and manage their financial flows. However, small and medium enterprises (SMEs) continue to struggle to access financial services from banks or larger borrowing organizations, because of a poor understanding of their cash flow and poor financial documentation. Banks are hesitant to provide financial services to SMEs because of this lack of financial transparency, which indicates a lack of trustworthiness. While DIT has made some improvements in addressing these issues, there is still room for improvement in the efficiency of the loan process and the ease of accessing related services.

Overall, supply chain trust management requires addressing the risks associated with material flow, such as data integrity and consistency, ensuring the integration and verification of information in the information flow, and improving trustworthiness and financial transparency in the financial flow. By implementing robust risk management mechanisms and controls, organizations can mitigate these risks, strengthen trust, and enhance the overall performance of the supply chain.

2.2. Blockchain Technology (BCT)

This section examines the history and key features of blockchain technology, along with its current and potential uses. BCT's opportunities are explored, as well as the challenges faced by businesses and organizations when using this innovative technology. The analysis includes the current state of blockchain adoption in trust management and predictions for future advances in this field.

2.2.1 What is Blockchain

Blockchain is a decentralized and distributed digital ledger technology that records and verifies transactions across multiple computers or nodes in a network. It is designed to be transparent, secure, and resistant to modification (Zheng et al., 2017). It is said to have the potential to transform many industries. Its features, including decentralization, immutability, transparency, and security, mean that it possibly has a wide range of applications (Zheng et al., 2017).

BCT is being studied for commercial applications in various industries, including finance (Li et al., 2020; Rijanto, 2021), healthcare (Azaria et al., 2016; Chen et al., 2019) and agriculture (Kamble et al., 2020; Kamilaris et al., 2019). This demonstrates that BCT possesses high scalability and adaptability as an underlying technology. Additionally, the implementation of BCT in different segments of the supply chain (Al-Rakhami & Al-Mashari, 2021) has been receiving significant attention in the academic community.

2.2.2. History of BCT

Blockchain technology was first introduced in 2008 as the underlying technology behind the digital currency Bitcoin. However, the concept of blockchain dates to the early 1990s, when researchers started exploring ways to create a secure digital timestamping system that could not be tampered with. Nakamoto (2008) published a white paper outlining the Bitcoin protocol, which relied on a decentralized, distributed database known as the blockchain. The blockchain serves as a public ledger that records all Bitcoin transactions and ensures the integrity of the system. As blockchain technology gained popularity, other cryptocurrencies and blockchain-based applications emerged. Ethereum, for example, was introduced in 2015 as a platform for building decentralized applications (dApps) using smart contracts, which are self-executing agreements that can automate complex processes (Valdeolmillos et al., 2020). Today, blockchain technology is being explored for a wide range of use cases beyond cryptocurrency, including supply chain management, identity verification, voting systems, and more.

Among below cases, there are two typical examples in which BCT technology has been actively deployed and utilised in commercial development by enterprises. These cases are worth mentioning for reference in future research.

IBM Case

As an American technology giant, IBM has applied for a significant number of blockchain technology patents. Since 2014, the company has been actively embracing blockchain technology and is far ahead of most companies in developing and using blockchain-based solutions. The most significant initiative by the company was the launch of IBM Blockchain in 2015. This platform is built on top of the Linux Foundation's Hyperledger Fabric, developed in collaboration with many other companies. IBM Blockchain is an enterprise blockchain solution tailored for large corporations and companies. It allows users to join existing blockchains or even create new platforms to suit their specific needs. According to IBM's website estimates, there are over 500 operational and effective blockchain projects. Notable blockchain projects include the TradeLens supply chain management platform, a joint development by shipping giant Maersk and IBM. This system tracks real-time data for shipping transactions and progress within permissioned networks. Another noteworthy platform is IBM's food tracking blockchain, which has entered several major corporate groups in the past two years. Companies such as Nestlé, Unilever, and leading U.S. retailer Walmart are all using blockchain-based food tracking platforms (Crosby et al., 2016).

Maersk x IBM Case

In pursuit of a common vision to establish an open and neutral industry platform and drive global supply chain digitisation, IBM partnered with Maersk to create TradeLens. By harnessing blockchain technology to enhance global trade and achieve supply chain digitisation, TradeLens aims to improve supply chain transparency and collaboration among enterprises in the industry. Blockchain can be seen as a novel decentralised protocol, and its application in the supply chain is aimed at increasing transparency and efficiency in business cooperation. However, due to persistent industry competition, whether in the shipping or logistics sectors, and the inherent nature of business relationships within the supply chain, concerns linger. Despite claiming to be an open and neutral platform, TradeLens itself has corporate affiliations, which can foster suspicions among peers and businesses along the supply chain, as no company wishes to hand over its core data to its competitors. The idea of data exchange becomes somewhat paradoxical. Competitors within the industry face trust issues when it comes to sharing data due to conflicting interests, presenting a core challenge that TradeLens is currently grappling with in its industry implementation (Kshetri, 2018).

Blockchain technology (BCT) has been gaining traction in business over the past few years, with many companies exploring the use of blockchain-based solutions to address various business challenges. The following table (Table 2) lists some key milestones for the application of BCT in business operations:

Year	Milestone	
2014	Overstock.com accepts Bitcoin as payment	Overstock.com became the first major retailer to accept Bitcoin as a payment method, paving the way for other businesses to follow suit (Kshetri & Voas, 2018).
2015	Introduction of Ethereum platform for decentralised applications	The blockchain-based platform Ethereum was introduced, offering businesses the ability to create their own decentralized applications and smart contracts (Swan, 2015).
2016	IBM launches blockchain platform for businesses	IBM launched its blockchain platform, providing businesses with a way to build and deploy blockchain-based solutions on a secure, scalable infrastructure (Crosby et al., 2016).
2017	Blockchain hype and numerous initial coin offerings (ICOs)	The hype around blockchain reached a fever pitch, with many businesses exploring the technology and numerous initial coin offerings (ICOs) raising billions of dollars in funding (Kshetri, 2018).
2018	Walmart and Maersk explore blockchain for supply chain management	Blockchain continued to gain momentum, with companies such as Walmart and Maersk exploring the use of blockchain for supply chain management and other applications (Kshetri, 2018).
2019	Facebook's Libra cryptocurrency faces regulatory pushback	Facebook announced plans to launch its own cryptocurrency, Libra, but faced significant regulatory pushback and ultimately scrapped the project (De Filippi et al., 2020).
2020	Increased interest in blockchain for supply chain management and contact tracing due to COVID-19	The COVID-19 pandemic highlighted the need for more efficient supply chain management and contact tracing, leading to increased interest in blockchain-based solutions for these applications (Ricci et al., 2021).
2021	Major financial institutions announce plans to offer blockchain-based solutions	Major financial institutions such as JPMorgan Chase and Visa announced plans to offer blockchain-based solutions to their customers, further validating the technology's potential for business use cases (Pal et al., 2021).

Table 2: Key Milestones for The Application of BCT In Business Operations

2.2.3. How BCT works

A blockchain is a decentralized data structure that enables information to be stored and shared among network members. Each block is uniquely identified by its cryptographic hash and linked to the previous block to form a chain. This allows any type of information to be securely stored and accessed by authorized members of the network. The blockchain serves as a fundamental underlying technology for a digital cryptocurrency system such as Bitcoin. It consists of a data structure where blocks containing transaction information are linked together in a sequential manner (Leng et al., 2020). The blockchain's fundamental structure comprises a solitary block encompassing the block header, block body, and version number. The block header contains three sets of block metadata. Typically, the blockchain incorporates four layers, including the data layer, network layer, consensus layer, and application layer (Almasoud et al., 2020).

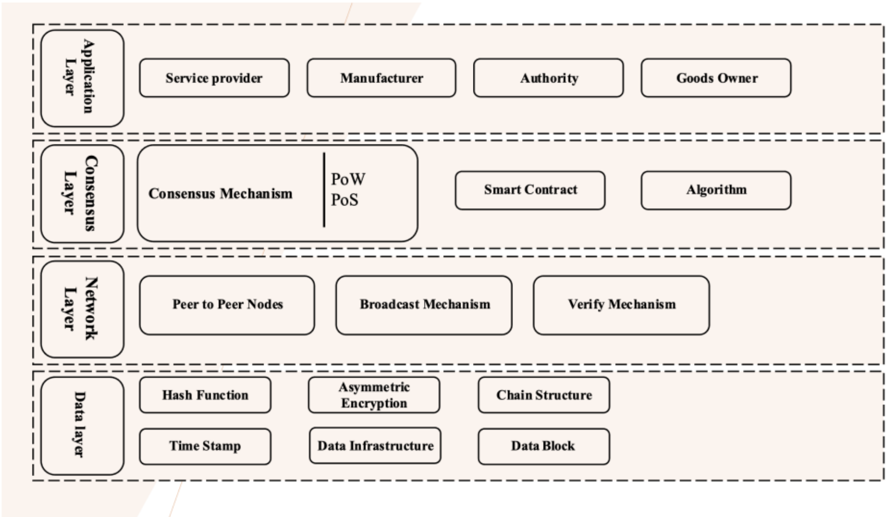

Figure 2: Basic Structure of Blockchain

2.2.4. Key features of BCT

Blockchain technology has several key features that make it unique and valuable for various applications:

Decentralisation:

Blockchain technology is decentralized, meaning it does not rely on a central authority to maintain and validate transactions. Instead, the network of nodes that operate the blockchain work together to validate and verify transactions, making it more secure and resistant to fraud (Swan, 2017; Tschorsch & Scheuermann, 2016). However, Viriyasitavat et al. (2019) noted that the complete decentralisation is often difficult to achieve in practice, particularly in public blockchains where anyone can participate in the network. Issues such as scalability, governance, and power imbalances can all affect the level of decentralisation in a blockchain network. As such, it is important to carefully consider the design and implementation of blockchain technology in order to achieve the desired level of decentralisation while maintaining security, efficiency, and accessibility.

Immutability:

Immutability ensures that once a transaction is recorded on the blockchain, it cannot be altered or deleted (Wang et al., 2020). This is achieved through the use of cryptography and a distributed consensus mechanism that ensures that all participants in the network agree on the state of the ledger.

Transparency:

Transparency is a core feature of blockchain technology that enables a public, immutable record of transactions to be maintained on the network (Saberi et al., 2019). This means that every participant in the blockchain network has access to the same information about transactions and can verify the authenticity of each transaction.

The level of transparency in a blockchain network depends on the type of blockchain being used. Public blockchains are fully transparent, allowing anyone to view and verify transactions on the network (Gabison, 2016; Guegan, 2017). Private blockchains, on the other hand, are often used in enterprise settings and may have restricted access, meaning that only authorised parties can view and verify transactions (Guegan, 2017; Zheng et al., 2017). Further, there are another form of blockchain between the public and private, that is, the consortium blockchain. Zheng et al. (2017) states that A consortium blockchain is a type of blockchain network where multiple organisations collaborate to maintain and validate transactions on the blockchain, which allows a higher level of flexibility and efficiency (O'Leary, 2017). In addition to transaction transparency, blockchain technology can also provide transparency in other areas, such as supply chain management. By using blockchain to track the movement of goods from production to delivery, companies can provide customers with an unprecedented level of transparency into the origin and quality of the products they purchase (Korpela et al., 2017).

Security:

Saberi et al. (2019) argue that in blockchain technology, the use of advanced cryptography provides several layers of security to ensure that the data stored on the blockchain is secure and tamper-proof. Encryption is a fundamental security mechanism that is used in blockchain technology to protect the data stored on the blockchain. Each transaction on the blockchain is encrypted using a unique key, which ensures that only the intended recipient can access and decrypt the transaction. This helps to prevent eavesdropping and ensures that only authorized parties can access the information stored on the blockchain.

Furthermore, blockchain technology employs a variety of encryption techniques, such as symmetric-key encryption and public-key encryption, to provide a high level of security. Symmetric-key encryption involves using the same key to both encrypt and decrypt data, while public-key encryption uses two different keys, one for encryption and one for decryption. The use of both encryption methods helps to ensure that the data on the blockchain is secure and cannot be easily accessed by unauthorised users (Saberi et al., 2019).

Consensus mechanism:

Blockchain technology uses a consensus mechanism to validate transactions on the network. This ensures that the integrity and security of the network. By requiring the agreement of a majority of the participants in the network, the consensus mechanism makes it incredibly difficult for any single participant or group to manipulate the blockchain for their own benefit (Lo et al., 2019).

According to Lo et al. (2019), the consensus mechanism works by requiring nodes in the network to solve complex mathematical equations in order to validate transactions and add them to the blockchain. Once a block of transactions has been validated and added to the blockchain, it cannot be modified or deleted without the agreement of the majority of the nodes in the network. This makes the blockchain an immutable ledger that provides a secure and transparent record of all transactions that have taken place on the network.

2.2.5. Use of BCT for trust management

The potential for blockchain technology (BCT) to transform trust management is significant. Trust management involves creating and sustaining reliable connections between people or entities through identity verification, transaction security, and risk management. However, establishing truth between organizations cannot solely rely on the technical aspects, but also associated with various considerations.

Trust in BCT can be understood through three main layers: the business operation layer, legal layer, and the technical layer. The business operation layer is the topmost layer of the blockchain architecture and focuses on the utilisation of blockchain application in various business operations and processes. Wu & Zhang (2022) claims that the BCT application in business operation involves designing and implementing blockchain solutions to enhance efficiency, transparency, and security in different industries. For instance, the supply chain industry can leverage blockchain technology to enable end-to-end traceability of goods, optimise inventory management, and minimise fraudulent activities (Wang et al., 2020). As the interface between the end-users and the blockchain solutions, this layer ensures the deployment of blockchain solutions in a manner that fosters trust and transparency among parties involved in the transactions.

Following (de Caria, 2020; Giancaspro, 2017; Savelyev, 2017), the legal layer is concerned with the legal aspects of blockchain technology, including the regulatory frameworks that govern its use. It includes compliance with data privacy laws and ensuring that blockchain solutions are legally enforceable. The primary goal of the legal layer is to establish a legal framework in non-technical aspects that enables blockchain technology to operate in a secure, fair, and compliant manner. For instance, de Caria (2020) noted that one of the key challenges in regulating the non-technical aspects of blockchain technology is the decentralised nature of blockchain networks. Decentralisation means that no central authority controls the network, making it difficult to establish clear legal frameworks and enforce compliance with regulations. The legal layer must therefore, work closely with other layers of blockchain architecture to ensure that the necessary legal and regulatory requirements are built into the system design.

The technical layer is the foundation layer, encompassing the design and development of its core components. This layer is responsible for creating the underlying infrastructure of blockchain networks, including its architecture, security features, and protocols. It involves developing and refining consensus mechanisms, smart contracts, decentralised databases, cryptographic protocols, and other key technical elements that enable blockchain systems' secure and reliable operation.

The three layers of blockchain architecture rely on one another, each building upon the layer below it. The Business operation layer provides objectives and applications at the operational level, the Legal layer establishes the legal foundation, and the technical layer develops the underlying infrastructure. Their collaboration produces a comprehensive framework that fosters trust and understanding of blockchain technology.

2.2.5.1. BCT application in trust management

BCT can support the creation of decentralised trust networks, where trust is established and sustained through consensus among network participants instead of relying on a central authority Batwa & Norrman (2021). According to Lo et al. (2019) smart contracts, which are self-executing agreements stored on the blockchain and executed when certain conditions are met, can help establish trust relationships between parties, such as in escrow services.

Saberi et al. (2019) noted that smart contracts are an innovative feature of BCT that can transform how contracts are executed and enforced. By coding contractual terms into the blockchain, smart contracts can automatically enforce the terms of an agreement when certain conditions are met without the need for intermediaries.

Automating contract execution has numerous benefits, including reducing transaction costs and increasing efficiency. Because smart contracts are self-executing and do not require intermediaries, they can significantly reduce the time and costs associated with contract execution. This is particularly beneficial in industries such as finance, where the use of smart contracts can streamline complex financial transactions and reduce the risk of errors.

Furthermore, Lo et al. (2019) argue that using smart contracts can help increase transparency and trust in the contracting process. Because the contract terms are coded into the blockchain and cannot be modified without the agreement of all parties, smart contracts provide a secure and transparent record of all contractual obligations and transactions.

In addition, blockchain technology offers a secure and transparent platform for building and maintaining trust relationships. The immutable nature of BCT ensures that information stored on the blockchain cannot be altered, resulting in high levels of security and transparency. For example, BCT has been utilised in the finance sector to comply with KYC (know your customer) /AML (anti-money laundering) regulations, which require businesses to verify customers' identities, assess their risk of financial crimes, and implement measures to detect and prevent money laundering and terrorist financing, including reporting suspicious transactions to relevant authorities (Malhotra et al., 2022). Smart Contracts integrated into a blockchain-based AML platform automate fraud detection by continuously monitoring transactions, alerting for suspicious activity, and blocking transactions automatically, significantly reducing the risk of finical crime and improving customer confidence in the transaction. Moreover, Malhotra et al. (2022) reveal that KYC blockchain systems offer transparency and immutability, allowing financial institutions to validate the integrity of data on the platform. Decentralised KYC processes provide a secure and efficient method for accessing up-to-date user data. That is, it can improve customer trust by ensuring the accuracy of user data and maintaining transparency throughout the entire KYC process.

Finally, BCT can be used to create secure and trustworthy digital identities, which can verify the identity of individuals or organisations. Digital identities are crucial in industries such as finance and healthcare, where sensitive information is exchanged, and identity verification is essential for maintaining security. Rivera et al. (2017) provide an example of how digital identities in healthcare can be advantageous is their ability to prevent medical identity theft and restrict access to patient data only to authorised healthcare providers. Moreover, blockchain-based digital identities can be self-sovereign, allowing individuals or organisations to have complete control over their identity and determine which information they want to disclose and to whom. This can result in lower chances of identity theft, data breaches, and improved privacy and data protection.

2.2.5.2. BCT in supply chain management

Based on the pervious discussion, inter-organizational trust can be developed by utilising the features of BCT, including traceability, real-time monitoring, digital identification, and smart contracts. The following table presents recent research on this topic:

Focus	**Focus**	**Research**
Blockchain traceability & Real-time monitor	BCT record and traceability system in textile and clothing supply chain	(Agrawal et al., 2018)
	Blockchains for Accurate Asset Tracking and Monitoring	(Walport, 2016) (Weber et al., 2016)
	Auditing manufacturing	(Turker & Altuntas, 2014)
	Minimising bullwhip effect by achieving demand forecasting	(Dujak & Sajter, 2019)
Smart contract & automation	Automation and Data Flow Acceleration in SCM	(Min, 2019)
Digital identity & verification	Blockchain Verification of Potential Suppliers	(Wang et al., 2019)
	Asset ownership verification	(Wang et al., 2019)
Decentralised network	Decentralised Trust Management System for Vehicular Networks using Blockchain	(Yang et al., 2018)

Table 3: Sample of Recent Research on BCT Applications

Based on the above discussion, existing BCT applications are mainly focused on a generic supply chain context. For example, Min (2019); Walport (2016); and Weber et al. (2016) based on blockchain characteristics to develop potential BCT applications from different perspectives. Yet, they do not discuss a particular area or component of the supply chain. Further, based on initial research for the current study, only a few researchers have investigated the relationship between container management and trust management among stakeholders by using blockchain technology, so it is critical to investigate how trust in container management can be affected by using blockchain technology.

Thus, this study aims to expand our understanding of these areas by using a systemic literature review to identify the application of blockchain technology and trust management in the context of container management specifically, focusing on understanding the impact of trust to improve the sustainability and efficiency of the industry.

Chapter 3 – Methodology

3.1. Methodology

This section serves as the foundation for conducting a systematic literature review (SLR) by elaborating on the research methodology implemented in this paper. The ultimate goal is to thoroughly comprehend how the utilisation of blockchain technology (BCT) impacts organisational trust within the scope of container management.

To achieve this objective, a SLR approach and guidelines proposed by Templier and Paré (2015) are followed that encompasses a systematic and structured analysis of existing literature. I gathered, evaluated, and synthesised relevant studies, scholarly articles, and reviewed papers that explore the intersection of BCT and organisational trust in container management. The guidelines help minimise bias and ensure an objective literature analysis on the subject.

Additionally, I utilised the PSALSAR framework; this framework includes protocol, search, appraisal, synthesis, analysis, and report, which was proposed by Mengist et al. (2020), as a conceptual framework to guide the search process. The PSALSAR framework provides a structured lens to examine the interplay between BCT and trust in the context of container management, and identify key themes, trends, and research gaps. By employing combination of SLR methodology and incorporating the PSALSAR framework, a systematic and objective analysis of the existing body of knowledge is expected to achieve and provide valuable insights on the implications of BCT adoption for organisational trust in the specific context of container management. The PSALSAR framework has six steps: protocol, search, appraisal, synthesis, analysis, and reporting, and they are explained below.

3.1.1. Protocol

The initial step in the research process involves defining the scope of the study, clarifying the research question, and establishing boundaries. The refined research questions are listed below; the research would comply with the PSALSAR approach to answer them:

- How does the adoption of blockchain technology influence trust among organisations involved in container management?
- What factors affect trust between the organisations involved in container management?

Based on the paragraph discussed earlier, this research draws inspiration from the emerging technology of BCT (Blockchain Technology). Within the domain of container management, persistent challenges, such as inadequate efficiency and imbalanced information acquisition and distribution, have resulted in inherent obstacles when it comes to optimising inter-organizational trust. Consequently, the research scope initially focuses on supply chain management, transportation, logistics, and trust management. Additionally, recognising the importance of trust management within supply chains, stakeholders and stakeholder management are deemed significant components to be considered in this research.

3.1.2. Search

This step is to conduct the strategy and delivery for searching and collecting papers and studies. The search strategy is to set appropriate strings and define suitable databases to collect related information and documentation. A robust search strategy is crucial in gathering relevant information and documentation effectively.

First, a set of keywords has been carefully chosen based on an initial exploration conducted on Google Scholar. These keywords are selected to enhance the precision and relevance of the search results. They are specifically tailored to capture the key themes and concepts of the research, ensuring that the retrieved materials are closely aligned with the research objectives. In addition to search strings, the selection of suitable databases is critical. For this research, the chosen databases for information retrieval are Scopus and ScienceDirect. These databases are widely recognised for their extensive coverage of academic literature across various disciplines.

As the result of the initial search in Google Scholar, the keywords will present as follow:

- “blockchain”, “blockchain applications”, “BCT”
- “supply chain”, “supply chain management”, “container management”, “logistics”, “transportation”, “maritime”
- “trust”, “organisational trust”, “trustworthiness”
- “information sharing”, “data sharing”

The result in Google Scholar shows that the selected keywords above exhibit a significant relationship with the intended research questions. Thus, the researcher combines the selected keywords as the input to the chosen database Scopus and ScienceDirect. Consequently, the final search strings will be as follow:

Scopus	(“blockchain” OR "blockchain applications" OR "BCT" AND "supply chain" OR "container management" OR "logistics" OR "maritime" AND "trust*" OR "organisational trust")
ScienceDirect	("blockchain" OR "blockchain applications" OR "BCT") AND ("supply chain" OR "container management" OR "logistics" OR "maritime") AND ("trust" OR "organisational trust")

I use different strings for the two databases because the ScienceDirect does not accept the sign "*" in their search function, so I have removed the wild card (*) to fulfil the requirements.

Second, inclusion and exclusion criteria are established within the search strategy. These criteria are crucial in filtering the search results, ensuring that only the most relevant and high-quality materials are considered for the study. Inclusion criteria outline the specific characteristics the retrieved documents must possess to include, such as publication type, language, and publication date. The search will focus on studies published between 2016 and 2022 to establish a clear timeframe. This timeframe allows for a comprehensive examination of recent developments in the field. It is worth noting that while the concept of blockchain technology was first proposed by Nakamoto in 2008, its initial application was primarily limited to the finance sector (Haferkorn & Quintana Diaz, 2015). Subsequently, its usage expanded to various industries, particularly in supply chain and logistics management (O'Leary, 2017). In terms of publication type, the search will specifically include peer-reviewed papers and studies. This criterion is implemented to minimise potential bias and maintain the quality and reliability of the sources. Consequently, grey literature, such as reports or unpublished materials are not included in the search results. Regarding language, only studies published in English will be considered for inclusion. This criterion ensures the research materials are accessible and comprehensible to the intended audience. Non-English studies are not included in the search to maintain consistency and facilitate effective analysis and interpretation of the findings.

3.1.3. Appraisal

In this stage, the selected literature undergoes a thorough review and assessment to determine its relevance and suitability for the subsequent research. The appraisal process encompasses three key phases: removing duplicates, selection of related studies, and quality assessment (Figure 3).

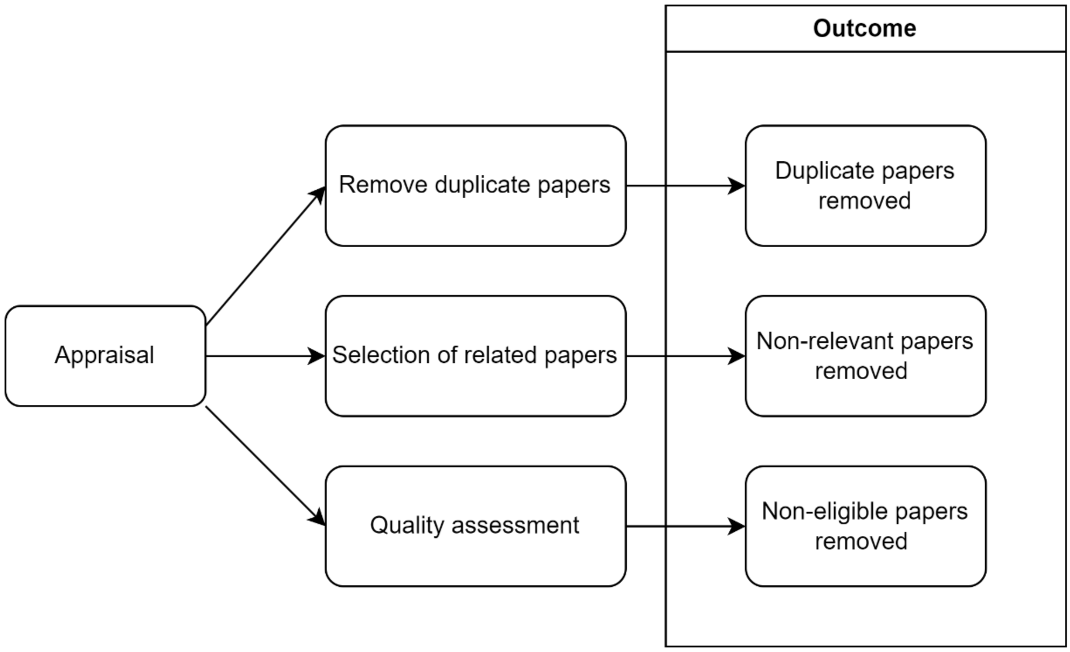

Figure 3: Appraisal Process

In the initial step, any duplicate publications are identified and eliminated to ensure that each study is considered only once. This step streamlines the review process and avoids redundancy in the analysis of the literature. In this step, papers have been excluded (n=379).

During the selection phase, strict adherence to the predefined inclusion and exclusion criteria, established earlier in the research, is maintained. Only literature that meets these criteria is included for further examination and consideration. This rigorous selection process ensures that the chosen studies align with the specific requirements and objectives of the research, contributing to the overall relevance of the findings. During this step, I thoroughly reviewed papers that were deemed non-relevant to the intended research (n=183). These exclusions were made based on clear criteria, such as the focus of the article being on topics like BCT for future 5G or BCT application in IoT. Although these topics may be relevant and important in their respective domains, they did not directly align with the specific research objectives of the current study.

In the subsequent quality assessment phase, a range of dimensions is considered to evaluate the selected papers. These dimensions act as indicators to assess the reliability and validity of the literature. In this step, the papers undergo further assessment by reviewing the abstract and main body to determine their eligibility for inclusion in the research. During this evaluation, non-relevant articles were excluded based on specific criteria (n=68). The reasons for exclusion include papers that are not relevant to the supply chain industry, papers that do not pertain to the domain of transport, logistics, and container management, and articles that solely focus on the technical aspects of Blockchain Technology (BCT)

During the last phase, a total of 68 relevant papers were included in the study, after excluding non-relevant literature (see Fig 4.). Through this appraisal process, the researcher ensures that the final collection of literature is aligned with the research objectives and directly relevant to the domains of supply chain industry, transport, logistics, and container management. This process helps maintain the integrity and focus of the study, ensuring that the chosen papers are reliable and valid, and contribute to the overall quality of the research findings.

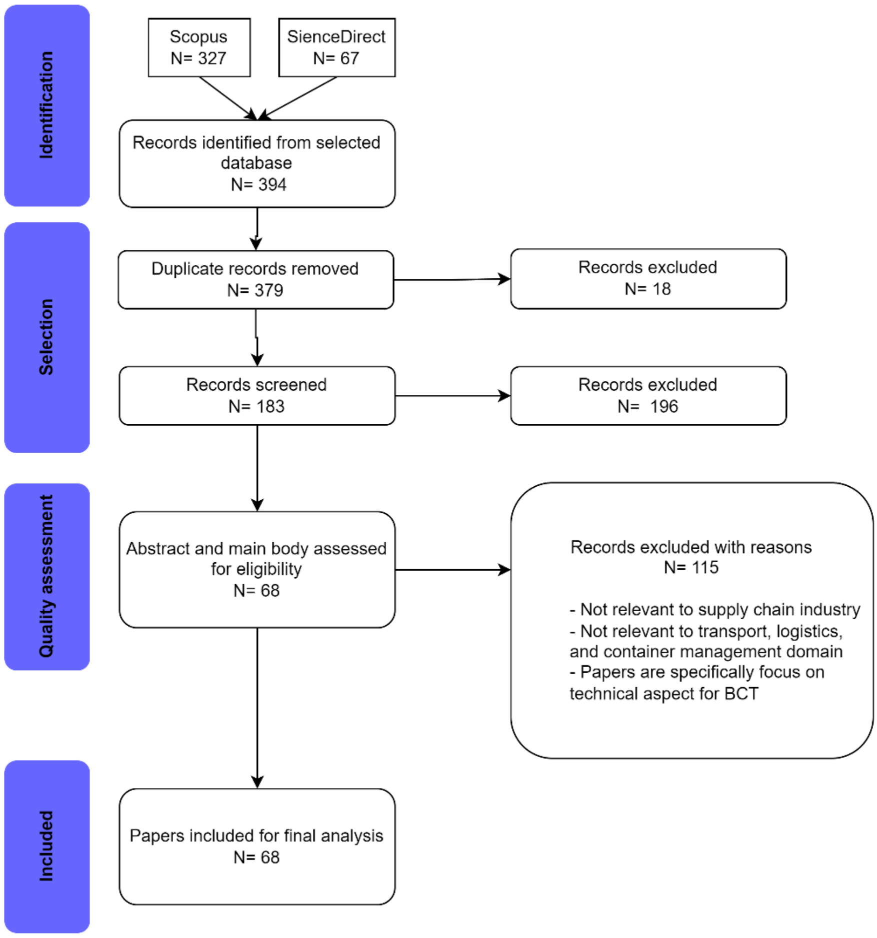

Figure 4: Steps for Shortlisting Papers to Review

3.1.4. Analysis

During this step, the focus is on extracting and classifying relevant data from the selected papers. The purpose is to derive valuable knowledge and findings that contribute to the research objectives. The process begins with the careful examination of the selected articles, wherein specific information is identified and extracted. This may include research methods, case studies, theoretical frameworks, or any other relevant information that can provide insights into the research topic. Once the data is extracted, it is organised and classified according to predetermined categories or themes. This classification helps in structuring the information and identifying patterns or relationships within the data. By systematically categorising the data, the researcher can uncover key trends, themes, or concepts that emerge from the literature.

Database	Search strings	Number of articles found
Scopus	(“blockchain” OR "blockchain applications" OR "BCT" AND "supply chain" OR "container management" OR "logistics" OR "maritime" AND "trust*" OR "organisational trust")	327
ScienceDirect	("blockchain" OR "blockchain applications" OR "BCT") AND ("supply chain" OR "container management" OR "logistics" OR "maritime") AND ("trust" OR "organisational trust")	67

Table 4: Database Used for Academic Literature

During my research process, I utilised two prominent databases, namely Scopus and ScienceDirect, to gather relevant literature for my study. The extensive collection of literature available in these databases proved to be highly valuable for exploring the topics of BCT and container supply chain management, as outlined in the table above. I discovered a significant number of literature sources within both Scopus and ScienceDirect that were directly related to my study. These sources demonstrated a clear relevance to my research objectives. Notably, most of the literature, approximately 83%, was sourced from the Scopus database.

Over this step, I performed two rounds of classification: the domain of research and research methods. The first round focused on the domain of research, which allowed researcher to determine how data is distributed across various domains. This classification aided in gaining a deeper understanding of the research content and its relevance to the research question. Additionally, it provided valuable statistical support for subsequent analyses. By classifying the data according to its domain, I could effectively organise and interpret the information, facilitating the identification of patterns, trends, and relationships within the dataset. This initial classification process laid the foundation for further analysis and ensured that the subsequent research methods aligned with the specific objectives of the study. Overall, the classification of the domain of research played a crucial role in refining the dataset and providing researcher with essential insights for subsequent analysis and interpretation.

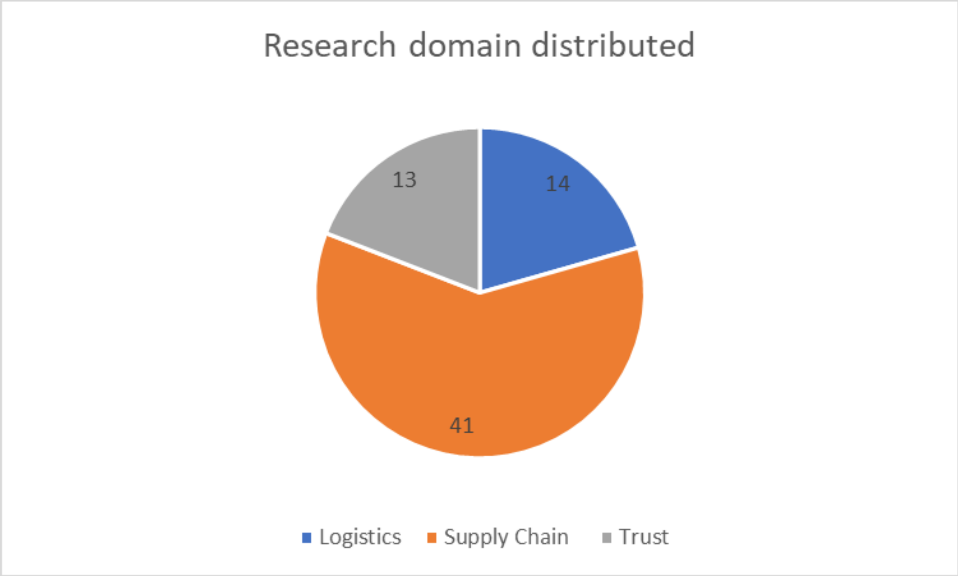

Figure 5: Research Domain Distribution

In the second round of classification, I focused on categorising the research methods employed by other scholars in their studies on similar topics. By determining the research field and examining the specific methodologies used, I gained insights into the current research trends. This classification process allowed them to assess the existing research landscape, identify any research gaps that may exist, and understand the current state of knowledge in the field. By analysing the research methods applied by other researcher, valuable information was obtained regarding the approaches, techniques, and tools utilised in studying the topic of interest. This classification of research methods provided me with a broader perspective and facilitated a deeper understanding of the research context. It served as a basis for drawing comparisons, identifying novel approaches, and potentially refining the research methodology for the current study. The insights gained from this classification process also provided a cornerstone for developing the subsequent framework in this study, ensuring that the research methodology aligns with the current trends and knowledge in the field.

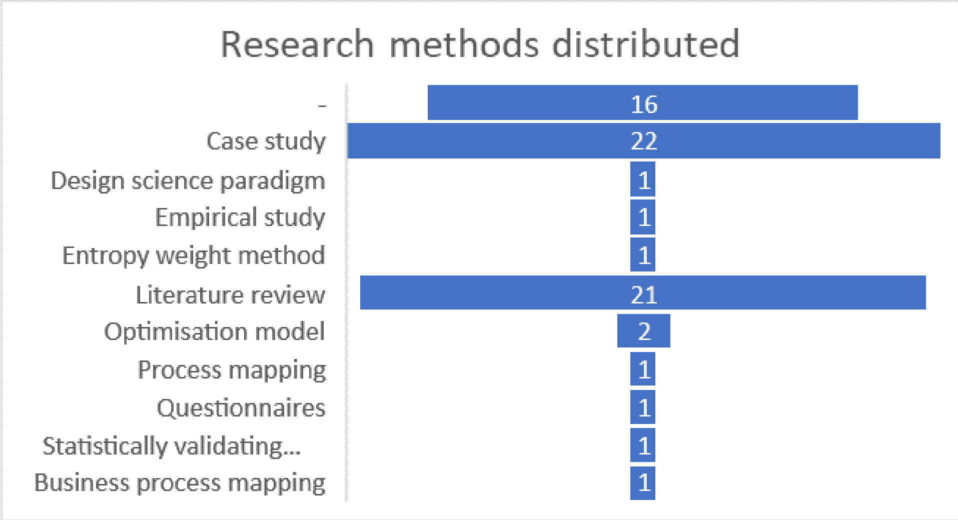

Figure 6: Research Methods Distribution

3.1.5. Synthesis

The synthesis section plays a crucial role in the research process as it involves extracting and consolidating the useful and relevant information collected during the previous search steps. This step helps to analyse and make sense of the gathered data, allowing researcher to draw meaningful conclusions and insights. During the synthesis phase, I carefully reviews the information and identifies key findings, patterns, and trends from 68 pre-identified studies. This may involve comparing and contrasting different sources, organising the data into relevant categories, and looking for connections or relationships between the collected information.

Based on the synthesis results, a comprehensive analysis of the 68 studies revealed significant insights into the logistics supply chain field. Information sharing and data sharing emerge as key focal points, garnering considerable attention in related research. These aspects are deemed the most crucial elements of the current logistics supply chain, addressing pertinent issues within the field. Among the selected studies, 28 of them explicitly mention information and data sharing, underscoring their paramount importance.

Furthermore, 59 studies shed light on the interplay between information and data sharing in the container supply chain and the concept of trust. This finding establishes a noteworthy correlation, suggesting trust is intricately linked to information and data sharing practices within this domain.

Delving deeper into research exploring blockchain technology, three prominent characteristics repeatedly emerge. Transparency, a fundamental attribute of blockchain, is cited 44 times in the selected studies. Traceability, another crucial feature, is highlighted 41 times, while decentralisation is mentioned 12 times. These figures convincingly validate the presence of these blockchain characteristics within the realm of logistics supply chain research. Consequently, it becomes evident that the characteristics inherent to blockchain technology make positive contributions to fostering trust in the logistics supply chain field.

Through a comprehensive analysis of 68 studies, it becomes evident that information sharing, and data sharing are of utmost importance in the logistics supply chain field. These aspects have garnered significant attention and are crucial in addressing pertinent issues within the industry. Moreover, the interplay between information and data sharing in the container supply chain and the concept of trust has been extensively explored in selected studies, highlighting a notable correlation. In the realm of blockchain technology, transparency, traceability, and decentralisation emerge as prominent characteristics, which are consistently present in logistics supply chain research. These characteristics contribute positively to fostering trust in the field. Overall, the synthesis phase of research enables a deeper understanding of key findings, patterns, and trends, providing valuable insights for advancing the logistics supply chain domain.

Chapter 4 - Findings

Based on the results obtained from the previous synthesis section, the report and discussion section of this study on trust in the container supply chain constructs synthesised a framework for understanding the influencing factors. The report section serves as a comprehensive summary of the research findings and their implications. It presents the key factors that have emerged from the synthesis of the collected information, highlighting their significance in shaping trust within the container supply chain. As a researcher, I synthesised this information to develop a framework to enhance inter-organizational trust in a blockchain technology (BCT) environment. This framework focuses on understanding the factors influencing the application of BCT and their impact on trust development. It provides an analysis of how these factors contribute to the establishment or erosion of trust in the container supply chain.

Analysing the authors and their main contribution topics in the 68 articles can be a valuable starting point to gain a comprehensive understanding of the extracted information. We can identify patterns, themes, and areas of expertise within the research field. This analysis will help us discern the key contributors and their specific contributions, allowing us to grasp the overall landscape of the subject matter more effectively. To achieve this objective, the researcher of the article utilises VOSviewer software as a visualisation tool to analyse the records. By employing this software, we can better understand the authors' contributions and their distribution within specific fields (Van Eck & Waltman, 2011). VOSviewer is a data mapping software that facilitates the exploration of patterns, relationships, and clusters among the authors, enhancing our comprehension of their research endeavours in a visually accessible manner (Van Eck & Waltman, 2010).

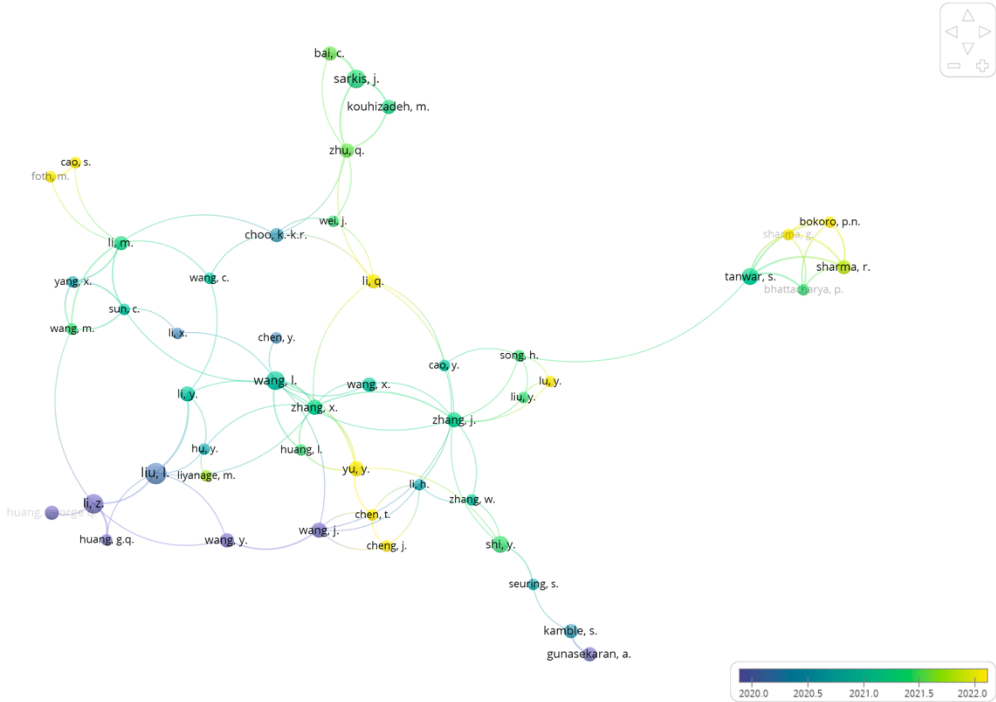

Figure 7: Author Contributions in Related Topics

The author of this paper employs the number of literature contributions associated with a specific author as a metric for evaluating their engagement in addressing related issues within a set of 68 relevant records. The author's decision to set the standard at 3 records is because the application of blockchain technology (BCT) in supply chain management is still in its early stages. Opting for a higher quantity level for inclusion would lead to a limited number of authors being considered. Among these, the finally selected articles are predominantly distributed between 2020 and 2022, with 2022 serving as the chosen cut-off year. The intensity of colour represents the temporal dimension of article publication, where darker colours correspond to earlier publication dates and lighter colours indicate more recent publications.

The data presented in Figure 7 indicates that out of the 68 examined records, 48 authors had carried out three or more studies to the body of literature on related topics. This outcome also demonstrates, from another perspective, the presence of overlap in mutual references and connections between authors in the field of BCT and supply chain when they contribute to the literature. Furthermore, this finding indirectly supports the notion of a significant correlation between the focus of this paper and the research direction pursued within the current mainstream academic area.

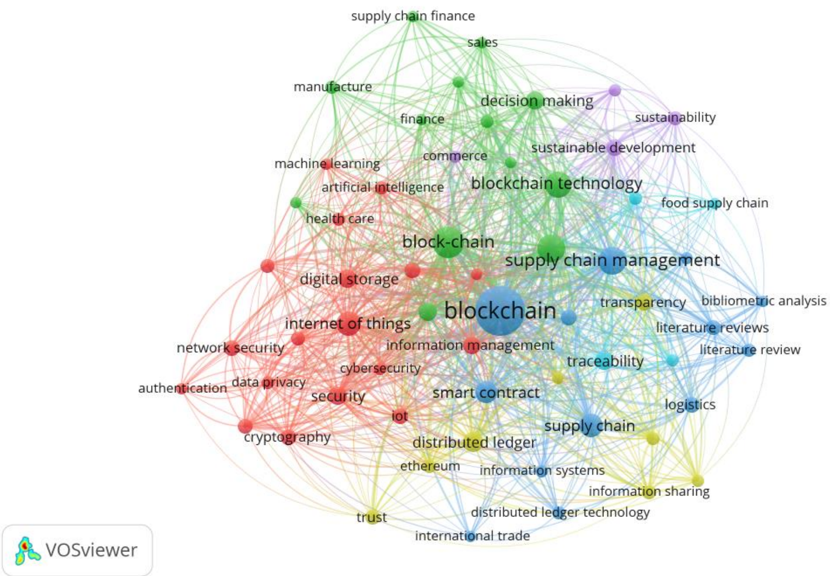

Figure 8: Correlations in Keywords

Moreover, I went through a meticulous process of extracting pertinent findings and keywords from a comprehensive set of 68 records. This approach aimed to identify significant information that could contribute to the study's objectives. I employed the frequency of keyword appearance in VOSviewer to determine the relevance and potential insights. This approach allowed for a quantitative assessment of the importance and prominence of specific keywords within the extracted records. By analysing the frequency of keyword occurrence, I could gauge the significance of each finding in relation to the study's focus. Additionally, by employing a quantitative metric, the author ensured a systematic and objective assessment of the relevance and potential insights derived from the extracted records' findings.

Keyword	Occurrences	Total link strength
blockchain	373	1303
block-chain	121	587
supply chains	90	479
supply chain management	95	372
internet of things	64	291
blockchain technology	78	278
smart contract	51	245
supply chain	61	230
distributed ledger	41	199
security	31	188
digital storage	34	180
information management	30	162
decision making	32	160
smart contracts	32	150
sustainable development	24	144
traceability	34	142
cryptography	21	101
iot	23	99
ethereum	15	98
surveys	17	97
food supply	14	96
information dissemination	14	95
literature reviews	19	94
data privacy	15	93
systematic literature review	21	93
sustainability	16	91
costs	14	90
information sharing	16	90
logistics	22	90
network security	22	81
information analysis	12	71
sales	11	69
cybersecurity	13	66
commerce	12	61
literature review	14	60
manufacture	14	60
risk assessment	10	59
environmental technology	12	58
traceability systems	12	58
trust	20	58
finance	10	57
internet of things (iot)	10	56
distributed ledger technology	15	47
industrial research	10	47
technology adoption	13	46
information systems	13	45

Figure 9: Correlations in Keywords Data

According to figure 9, the column "total link strength" reveals that attributes "BCT," "blockchain," and "blockchain technology" exhibit a notably high correlation with other attributes. Additionally, attributes like "supply chain," "smart contract," "transparency," "trust," "traceability," and "information sharing" also display substantial link strength. This indicates a clear and robust correlation between BCT and the supply chain, particularly concerning aspects such as transparency, smart contracts, trust, traceability, and information sharing. These findings underscore the significant interconnection among these factors, emphasising their collective importance in shaping the relationship between Blockchain technology and the supply chain.

Upon analysing the articles included in my research, I observed a coherent pattern and identifiable themes that emerged when examining them in the context of my research question. In total, I thoroughly reviewed approximately 68 scholarly articles, which have provided valuable insights into my chosen subject matter. Each theme represents a recurring concept or idea that appeared consistently across the articles I examined. By identifying and analysing these key themes, I gained a deeper understanding of the various perspectives, trends, and findings within the body of literature. Table 5 below presents a summary of the key themes that surfaced as a result of the SLR:

BCT-related Themes	**Impact on container management**	**Reference**
Information asymmetry	Blockchain technology (BCT) has the potential to enhance transparency and address information asymmetry. This is particularly beneficial in the container supply chain, where transparency is crucial in facilitating prompt and accurate business decisions for upstream and downstream partners. Improved transparency also fosters increased confidence and trust among partners.	(Li et al., 2018; Yang et al., 2021)
	Blockchain technology (BCT) empowers business partners (BP) by mitigating information barriers prevalent in various business processes and entities. It facilitates the identification of responsibilities among relevant parties and enables cross-organizational synchronisation, thereby enhancing collaboration and efficiency. This transformative capability significantly reduces information inequality factors found in conventional commercial organisations, where information sharing is typically delayed and susceptible to incorrect communication.	(Liu et al., 2021)
Information traceability and accessibility	BCT traceability can facilitate quality control by recording data related to production, storage, and transportation conditions. In case of product recalls or quality issues, BCT can enable swift identification and	(Meidute-Kavaliauskiene et al., 2021; Yousefi &

	targeted removal of affected products, minimising risks to consumer safety. Further, BCT can facilitate product authentication by creating a digital fingerprint or unique identifier for each item. Customers and stakeholders can verify the authenticity of goods, reducing the risk of counterfeit products and ensuring quality standards are met.	Mohamadpour Tosarkani, 2022; Zheng, 2022)
	Finally, BCT can solve the current situation of information asymmetry at the technical level. By utilising the immutable nature of the blockchain, it becomes impossible to tamper with the data that has been saved. In addition, the concept of public chain, private chain, and alliance chain can allow supply networks of different scales and business models to be effectively managed. Greatly improve the security and accessibility of business information circulation	(Dutta et al., 2020; Dwivedi et al., 2020a; Fernandez-Vazquez et al., 2022; Karakas et al., 2021)
Process automation	BCT smart contracts can automate processes based on predefined conditions or triggers. For example, when a specific event occurs or a certain set of data is received, the smart contract can automatically initiate the next step in the process. This conditional automation reduces delays, improves responsiveness, and enables real-time decision-making based on accurate and validated data. BCT smart contracts enable peer-to-peer interactions without the need for intermediaries or centralized authorities. This disintermediation can streamline processes by eliminating unnecessary layers and reducing dependencies. It fosters direct collaboration between parties, enabling faster and more efficient execution of automated processes.	(Dwivedi et al., 2020b; Juma et al., 2019; Natanelov et al., 2022; Yang et al., 2021; Yousefi & Mohamadpour Tosarkani, 2022)

Table 5 Summary of The Key Themes

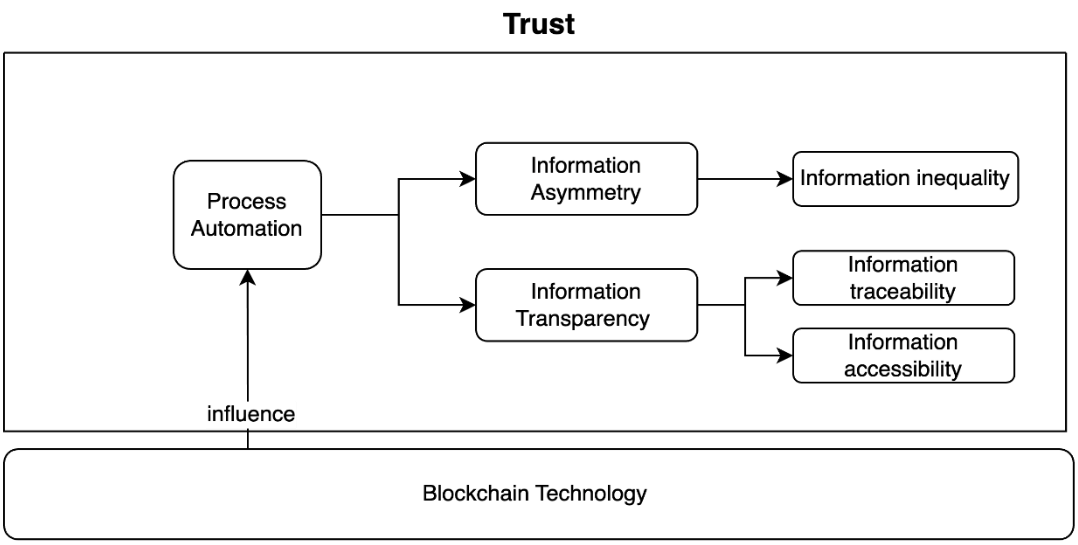

Figure 10: Framework Diagram

In conclusion, the implementation of Blockchain technology (BCT) in container management provides a robust framework (Figure 10) that addresses critical aspects of transparency, traceability, information asymmetry and process automation. BCT's ability to enhance transparency and overcome information asymmetry fosters confidence and trust among partners in the container supply chain. The traceability features of BCT ensure quality control by recording essential data, enabling swift actions during product recalls and enhancing authentication to combat counterfeit products.

Furthermore, BCT's immutable nature and decentralised structure significantly improve the security and accessibility of business information circulation. The use of smart contracts automates processes, reducing delays, improving responsiveness, and enabling real-time decision-making based on reliable data. The disintermediation aspect streamlines container management processes, fostering direct collaboration and more efficient execution.

By embracing the potential of Blockchain technology, organisations involved in container management can benefit from this proposed framework that not only enhances operational efficiency but also strengthens trust and cooperation among stakeholders. As BCT continues to evolve, its transformative capabilities promise to revolutionise container management and drive the industry towards a more secure, transparent, and reliable future.

Chapter 5 – Discussion and Conclusions

5.1. Discussion

Based on the insights derived from the synthesis of the selected articles, the extensive integration of blockchain technology for container management among diverse partners has the potential to impact trust significantly. However, due to its early developmental stage, partners may face challenges such as conflicting goals (Wan et al., 2020), limited financial resources (Min, 2019), and varying levels of expertise in constructing and maintaining blockchain structures and infrastructures (Kouhizadeh et al., 2021).

Consequently, only a few successful use cases have emerged that have effectively harnessed the tangible benefits of this technology. For instance, Maersk and IBM have collaborated to create a blockchain-based platform, leveraging the transparency, immutability, and decentralised nature of the technology, to enhance information sharing among business partners.

5.1.1. Container-related processes inside and outside ports

To develop a comprehensive understanding of the potential applications of blockchain in the container supply chain, it is crucial to examine the underlying processes involved. Internally, a port operates through a complex network of operational departments, each assigned specific functions (Notteboom et al., 2019). These departments include gate control, schedule planning, terminal management, and container depot operations.

Within the port's infrastructure, each department independently manages and possesses its own data (Yi et al., 2000). This internal data serves as a vital resource for ensuring efficient port operations and facilitating decision-making processes (Yi et al., 2000). Externally, the port interacts with various stakeholders who also maintain their own specific databases or information systems (Board, 1999). These stakeholders include shipping lines, freight forwarders, transportation providers, and goods owners. Each entity relies on its unique set of data and information systems to support its operations and meet its business requirements. The external databases contain valuable information related to shipments, logistics, documentation, and other relevant aspects tied to their respective roles in the port ecosystem. Additionally, in terms of governance and regulatory oversight, both the port authority and customs authorities maintain their separate databases (Brooks, 2004). The port authority oversees the overall functioning and administration of the port, ensuring compliance with regulations and policies. Customs authorities manage the clearance and inspection of goods, maintaining a database of import/export declarations, duty payments, and other pertinent information. Given the diverse range of stakeholders and their distinct business demands, the generation of data from multiple business processes becomes inevitable. Each stakeholder, whether internal or external, has specific interests and requirements associated with their operations within the port (Ashrafi et al., 2020).

For instance, the gate control department necessitates data on incoming and outgoing vehicles, while the schedule planning department requires information on vessel schedules and berthing arrangements. Similarly, shipping lines rely on data for cargo bookings and tracking, freight forwarders need data for arranging transportation and logistics, and goods owners seek information on inventory and shipment status. In conclusion, the efficient operation of a port relies on the effective management and integration of diverse data sources from both internal departments and external stakeholders. This facilitates seamless coordination and decision-making throughout the port ecosystem. Understanding the complexities and intricacies of these data sources is crucial when exploring the potential applications of blockchain technology in improving transparency, security, and efficiency within the container supply chain.

5.1.2. Business process interdependencies

Moreover, the interdependence of business processes within different departments of a port is highly significant, particularly when it comes to the seamless and timely sharing of container information among relevant parties (Notteboom et al., 2019). This interdependence becomes particularly evident in critical areas such as gate control and customs inspection processes.

In the gate control process, the availability of accurate and up-to-date container information is paramount. Details such as container numbers, seal numbers, contents, hazardous grade, and associated documentation play a crucial role. The gate control department relies on this information to ensure that the correct containers are granted access to or exit from the port premises. This process is essential for maintaining security, preventing unauthorised entry or exit, and facilitating efficient operations. To achieve this, the gate control department depends on timely updates from other departments within the port, such as the terminal and container depot. These departments provide data on container movements and status, enabling the gate control department to make informed decisions.

Similarly, the customs inspection process heavily relies on comprehensive container information. Customs authorities require access to accurate data concerning the contents of containers, including detailed descriptions of goods, quantities, and any relevant regulatory or legal documentation. This information is critical for assessing the compliance of goods with import/export regulations, verifying the accuracy of customs declarations, and detecting any potential security risks or contraband. To perform these tasks efficiently, customs authorities must have access to the necessary container information, which may originate from internal departments, shipping lines, or freight forwarders.

In the gate control and customs inspection processes, the secure and prompt sharing of container information is of utmost importance. Any delays or inaccuracies in the exchange of information can lead to disruptions in port operations, increased security risks, non-compliance with regulations, and potential financial losses (Nikghadam et al., 2021).

Therefore, establishing effective communication channels and secure data-sharing mechanisms is crucial for facilitating robust trust and smooth information sharing between gate control, customs authorities, and other relevant departments within the port. By ensuring the seamless flow of container information across various departments and stakeholders, ports can enhance their overall efficiency, strengthen security measures, and foster a collaborative environment built on trust and reliable data exchange.

5.1.3. Information asymmetry

To promote secure and efficient data sharing, advanced information systems and technologies are commonly employed in ports (Kapkaeva et al., 2021; Kia et al., 2000; Mlimbila & Mbamba, 2018). Their primary purpose is to ensure that relevant data reaches the appropriate stakeholders promptly, minimising delays and errors in critical processes like gate control and customs inspections. Furthermore, data sharing within port departments extends beyond container information alone (Shaw et al., 2017). Other pertinent data, such as vessel schedules, berthing plans, and transportation details, may also need to be shared to optimise port operations (Heilig & Voß, 2017; Shaw et al., 2017; Yin et al., 2011).

Collaborative platforms and integrated information systems streamline these data exchanges, fostering transparency, efficiency, and informed decision-making throughout the port ecosystem (Bradley et al., 2019; Heilig & Voß, 2017). By adopting advanced information systems and technologies, ports enhance operational processes, reduce delays, and encourage collaboration, ultimately contributing to overall optimisation.

However, it is essential to note that while the current information management systems serve as bridges for facilitating information communication between relevant parties, they primarily address the need for data exchange at specific trigger points. These technologies act as facilitators rather than directly resolving the underlying information asymmetry present within the container supply chain (Yang et al., 2022). Information accessibilities are not evenly distributed among the various stakeholders (Clarkson et al., 2007). The entity or department that owns a specific business process holds a favourable position in terms of information asymmetry (Lambourdiere & Corbin, 2020). They better understand the specific data and information related to their process, giving them an advantage within the entire chain.

Consequently, organisations with a greater number of business processes within the supply chain solidify their advantageous position in terms of data and information (Li et al., 2013). They possess a broader knowledge base that encompasses multiple aspects of the container's journey, including origin, destination, transportation, customs requirements, and more. This comprehensive understanding enhances their decision-making capabilities and grants them greater control over the information flow within the chain.

While initiatives such as data-sharing platforms and standardised protocols aim to address these asymmetries and promote transparency, challenges persist. The unequal distribution of information power remains a concern, and stakeholders with limited access to certain data may encounter difficulties in fully comprehending and optimising their operations. This information asymmetry can result in inefficiencies, delays, missed collaboration opportunities, and hindered process improvement (Li et al., 2013). Overcoming these challenges is crucial for fostering transparency, reducing inefficiencies, and unlocking the full potential of the port ecosystem while addressing the information power asymmetry within the container supply chain.

To address this information power asymmetry, blockchain technology can leverage its decentralised and transparent nature to provide equal access to information for all stakeholders (Chen et al., 2017; Longo et al., 2019). By utilising its immutable and traceable ledger, blockchain can enhance transparency and trust, ensuring that data is shared in a fair and secure manner. The existing information power asymmetry not only impacts operational efficiency but also significantly affects organisational trust.

Trust is crucial in successful business relationships, relies on transparency, reliability, and fairness in information sharing (Bews & Rossouw, 2002; Rawlins, 2008; Schnackenberg & Tomlinson, 2016). When certain stakeholders possess more information while others have limited access, it creates distrust and suspicion. Doubts arise regarding the accuracy and completeness of information (Krishnan et al., 2006), leading to concerns about the fairness of decision-making and potential hidden agendas. Lack of trust hinders collaboration and discourages the sharing of sensitive information, impeding effective decision-making and delaying processes, thereby undermining the overall efficiency of the container supply chain. Blockchain technology provides a better solution for addressing this information power asymmetry within the container supply chain.

By leveraging the decentralised and immutable nature of blockchain, stakeholders can establish a transparent and secure platform for data sharing and verification. Blockchain offers a distributed ledger that enables real-time updates and ensures that information is shared in a tamper-proof manner. This technology enables the creation of smart contracts and automated workflows, reducing reliance on intermediaries and enhancing trust among participants. Through blockchain, stakeholders can have equal access to validated and trusted information, levelling the playing field and fostering collaboration. Embracing blockchain technology empowers the container supply chain to overcome information asymmetry, build trust, and unlock new opportunities for efficiency and innovation.

5.1.4. Information accessibility and traceability

It is crucial to recognise that the current challenges in managing information within the container supply chain stem from issues related to information accessibility and traceability, rather than solely information asymmetry. While existing information management systems facilitate communication between relevant parties, they often focus on data exchange at specific trigger points, rather than addressing the underlying issues of information accessibility throughout the entire supply chain.

Within the container supply chain, stakeholders face uneven distribution of information ownership and access. Certain entities or departments that are responsible for specific business processes hold a position of advantage in terms of information accessibility (Davenport & Short, 1990). Their comprehensive understanding of the data and information associated with their processes grants them control over the flow of information within the chain. Organisations with a greater number of business processes further solidify their advantageous position by possessing a broader knowledge base that encompasses multiple aspects of the container's journey (Luftman et al., 1993). Efforts have been made to address these accessibility and traceability issues by promoting transparency through initiatives such as data-sharing platforms and standardised protocols.

However, challenges persist, and the unequal distribution of information power remains a concern. Stakeholders with limited access to certain data face difficulties in fully comprehending and optimising their operations (Gupta et al., 2019). This information asymmetry leads to inefficiencies, delays, missed collaboration opportunities, and obstacles to process improvement. Overcoming these challenges is crucial for fostering transparency, reducing inefficiencies, and unlocking the full potential of the container supply chain. The existing information power asymmetry not only affects operational efficiency but also significantly impacts organisational trust. Unequal access to information raises concerns about the fairness of decision-making processes (Green, 2022; Katok & Pavlov, 2013; McGarraghy et al., 2022).

Stakeholders with limited information may question whether decisions are being made based on complete and accurate data. They may worry that those with greater information power could have hidden agendas or biases that could influence decision outcomes. This uncertainty erodes trust and hampers collaboration among stakeholders. Moreover, the lack of trust stemming from information accessibility and traceability issues can severely impede effective decision-making (Rainero & Modarelli, 2021).

When participants do not have confidence in the information being shared, they may hesitate to make decisions or take action (Nicholson, 2015). This indecisiveness can lead to delays, missed opportunities, and inefficiencies in the container supply chain. Decision-makers may be reluctant to act without full transparency, fearing negative repercussions or unfavourable outcomes due to incomplete or biased information.

The consequences of this distrust and compromised decision-making extend to the overall efficiency of the container supply chain. When collaboration is hindered, stakeholders may withhold valuable information or resist sharing sensitive data (Van Os et al., 2015). This obstructs effective coordination and cooperation among participants, causing bottlenecks, process delays, and missed opportunities for optimization.

The lack of trust and transparency undermines the smooth flow of operations, inhibiting the ability of the container supply chain to function at its highest potential. In conclusion, shifting the focus from information asymmetry and power to information accessibility and traceability issues sheds light on the challenges faced within the container supply chain. Addressing these issues is vital for promoting transparency, trust, and collaboration among stakeholders, ultimately leading to enhanced operational efficiency and unlocking the full potential of the container supply chain.

5.1.5. BCT solutions

To overcome the challenges of information asymmetry, traceability, and accessibility in the container supply chain, proactive measures are crucial. Resolving this issue requires implementing strategies that ensure fair information access for all stakeholders. Establishing a framework promoting transparency, reliability, and fairness in information sharing is key to restoring trust and fostering collaboration. When participants have confidence in the accuracy and integrity of exchanged data, they are more likely to actively engage, freely share insights, and work towards common goals.

Blockchain technology offers significant advantages in building trust among stakeholders in the container supply chain. One notable benefit is the creation of an immutable and tamper-proof record of container transactions and movements (Helo & Hao, 2019; Selvathasan, 2023). Every action, including loading, unloading, and transfers, is transparently and verifiably recorded on the blockchain (Perboli et al., 2018; Xu & Yang, 2021). Such transparency plays a crucial role in enhancing trust among supply chain participants. It ensures transparency by providing equal access to accurate and unaltered information throughout the container's journey. With end-to-end traceability, stakeholders gain a comprehensive understanding of a container's history (Anastasiadis et al., 2022). Information like origin, ownership, maintenance, and current location can be reliably recorded on the blockchain, serving as a transparent data source (Niranjanamurthy et al., 2019). Additionally, consensus mechanisms and cryptographic techniques ensure data accuracy by requiring agreement among participants and providing robust security measures to protect the integrity and authenticity of the recorded data.

A prime example of the benefits of blockchain technology is its ability to mitigate the risks associated with counterfeit containers. By maintaining detailed records of container specifications, ownership transfers, and maintenance history on the blockchain, stakeholders can verify the authenticity and condition of containers. This verification process enhances security and builds trust among participants, reducing the potential use of counterfeit or substandard containers. Blockchain also enables secure and direct transactions, eliminating the need for intermediaries. Through the use of smart contracts and automated workflows, reliance on intermediaries is reduced, enhancing trust. This automation minimises errors and disputes that may arise from manual processes and lowers associated costs. Payments, fees, and other financial obligations can be executed transparently and automatically through smart contracts on the blockchain. Such streamlined and secure transactions contribute to trust development by ensuring reliable and accountable financial agreements.

In summary, implementing blockchain technology in the container supply chain provides transparency, traceability, and trust development. The immutable record of container transactions builds confidence among stakeholders, as all parties have equal access to accurate and unaltered information. By addressing information reliability risks and enabling secure transactions, blockchain enhances security, reduces errors, and fosters trust among participants.

Various factors influence the trust between organisations involved in container management. Trust is fostered through transparency, achieved by openly sharing information and data among partners. Effective and honest communication, consistent delivery on commitments, a positive track record, and a reliable reputation all contribute to building trust. Moreover, organisations prioritising data security, adhering to legal and regulatory requirements, and promoting collaborative and fair practices are more likely to gain trust within the container management ecosystem.

Blockchain technology has a significant impact on trust between organisations in container management. By providing a transparent and immutable record of transactions, blockchain instils confidence in the accuracy and integrity of data. Its decentralised nature reduces the reliance on intermediaries, promoting direct peer-to-peer interactions and elevating trust levels. Advanced security features, like cryptographic data protection, further enhance trust in safeguarding sensitive information. Smart contracts automate agreements and minimize human errors, increasing reliability and trust. Additionally, blockchain's traceability capabilities enable organisations to monitor shipping container lifecycles, fostering accountability and trust among all stakeholders in the supply chain. Overall, blockchain positively influences trust by ensuring transparency, traceability, and security in container management processes.

5.2. Future research

Future research in understanding and developing trust by BCT among stakeholders in the container supply chain can be explored across several aspects: BCT adoption, the shift from trusting humans/organisations towards trusting technology and the optimisation of the cost of BCT solutions.

5.2.1. Education in BCT adoption

Future research can place significant emphasis on the role of education and training in promoting the adoption of Blockchain Technology (BCT) in the container supply chain and its importance in mitigating operational risks. It is essential to understand the factors that influence BCT adoption and explore strategies to encourage its wider acceptance and implementation.

To facilitate the adoption of BCT, future researchers can focus on understanding how educational programs, training, and similar initiatives that target different stakeholders within the container supply chain influence BCT adoption. These programs can raise awareness about the potential benefits of BCT and address misconceptions or uncertainties surrounding its implementation. Additionally, future studies can focus more on case studies and empirical studies can serve as valuable tools for showcasing successful BCT adoption examples, highlighting the positive outcomes achieved by early adopters.

Moreover, understanding the drivers and inhibitors of BCT adoption is crucial for BCT adoption is another research area. Researchers can investigate the motivations behind stakeholders' decisions to adopt or resist BCT, identifying key factors such as cost-effectiveness, regulatory compliance, competitive advantage, and risk reduction. By gaining insights into these factors, educational and training initiatives can be tailored to address specific concerns and promote the adoption of BCT.

5.2.2. Shift from trusting humans/organizations to trusting technology

Another future research topic could be to understand better the profound shift from traditional human-centric models of trust to placing trust in technology itself, enabled by Blockchain Technology (BCT). This shift is a result of BCT's ability to establish decentralized and transparent systems. Understanding stakeholders' perceptions and trust placement in the underlying mechanisms, algorithms, and security features of BCT becomes crucial in this context.

Researchers can investigate how stakeholders perceive and develop trust in the various components of BCT. This includes exploring their confidence in the immutability and integrity of data stored on the blockchain, the reliability of consensus protocols that validate transactions, and the security measures implemented through cryptographic techniques. Understanding the factors that influence stakeholders' trust in these aspects of BCT can help uncover the dynamics of trust in the container supply chain.

Examining trust-building mechanisms within BCT becomes an important area of research. This entails studying consensus protocols employed in the blockchain network, such as Proof of Work (PoW) or Proof of Stake (PoS) and evaluating their impact on establishing trust among stakeholders. Additionally, investigating the role of smart contracts in automating and enforcing trust-based agreements can contribute to a deeper understanding of trust dynamics within the container supply chain. The use of cryptography, including public-key infrastructure and digital signatures, can also be explored to assess how these security measures impact trust perceptions.

By exploring the shift from trusting humans/organisations to trusting technology, researchers can gain insights into the evolving dynamics of trust within the container supply chain. This further research can contribute to a deeper understanding of stakeholder perceptions, inform the design of trust-enhancing mechanisms in BCT, and facilitate the establishment of reliable and secure trust relationships in this technology-enabled context.

5.2.3. Optimization of the costs of BCT solutions

The cost factor plays a pivotal role in determining the adoption and implementation of Blockchain Technology (BCT) in the container supply chain. Future research can concentrate on optimizing the cost of BCT solutions to facilitate wider adoption in this context. This exploration encompasses several dimensions, including cost-effective implementation models, scalability, and efficiency of BCT platforms, and strategies to reduce transaction costs, infrastructure requirements, and operational overhead associated with BCT adoption.

Future studies can investigate different approaches for deploying BCT in the container supply chain to achieve cost-effective implementation models. This may involve examining hybrid models that integrate existing systems with blockchain functionalities, assessing the feasibility of cloud-based BCT solutions, or exploring collaborative frameworks that distribute costs among multiple stakeholders (Sander et al., 2018). By identifying cost-efficient implementation strategies, stakeholders can be encouraged to adopt BCT without incurring excessive financial burdens.

Another area of focus is the scalability and efficiency of BCT platforms. Research can delve into enhancing the performance of BCT systems to handle the scale and complexity of container supply chain operations. This can involve exploring techniques such as sharding, sidechains, or off-chain solutions to improve BCT networks' throughput and transaction processing capabilities (Brotsis et al., 2021; Uddin et al., 2021). By addressing scalability challenges, BCT can become a more viable and cost-effective solution for the container supply chain.

In summary, future research can focus on optimising the cost of BCT solutions in the container supply chain. By exploring cost-effective implementation models, scalability and efficiency of BCT platforms, and strategies to reduce transaction costs and operational overhead, researchers can pave the way for wider adoption of BCT. Assessing cost-benefit trade-offs helps stakeholders evaluate the financial viability of BCT implementation, facilitating the realisation of its potential benefits in enhancing the container supply chain.

By addressing these aspects, future research can contribute to a better understanding of BCT's adoption and trust dynamics in the container supply chain. This knowledge can guide stakeholders in making informed decisions regarding BCT implementation, fostering trust, and realising the potential benefits of this technology in enhancing transparency, traceability, and collaboration within the container supply chain.

5.3. Limitations

- Using secondary data

One drawback of this study is the utilisation of secondary data. The findings showed that trust in the container supply chain should be examined in specific business procedures. These procedures encompass variations in the interests of diverse stakeholders, leading to a misalignment between overall business requirements and objectives. Relying on secondary data in this study leads to a potential disparity between the selected research cases and the research topic. This dissimilarity can manifest itself in terms of regional culture, company size, and national policies. These factors may introduce additional deviations in assessing the interests of relevant parties and analysing subsequent strategies, ultimately impacting the research outcomes. These issues can be addressed by in-depth research on the business processes in a specific country or region to gather primary data from local stakeholders. This primary data will help the researcher to reduce influence factors and generate valuable research outcomes.

- Using only English language articles

The limitation of accepting only English as the research language in the paper selection process for systematic literature reviews (SLRs) can indeed have a significant impact, particularly for topics related to the international environment, such as container supply chain studies. By accepting only English papers in SLRs, valuable research conducted in other languages will be excluded. This can result in a restricted pool of literature and overlook important studies and perspectives from non-English-speaking researchers, regions, or countries. Container supply chain topics involve international trade, logistics, and global operations. Restricting the research language to English may inadvertently introduce a geographical bias, favouring research from English-speaking countries or regions where English is commonly used. This bias can limit the representation of diverse contexts and practices in container supply chains worldwide. Language barriers hinder collaboration and knowledge exchange between researchers from different linguistic backgrounds. By excluding non-English research, opportunities for interdisciplinary collaboration, comparative analysis, and the integration of diverse perspectives may be missed. This can limit the advancement and innovation in the field of container supply chains.

- <u>Spelling variance for search terms</u>

During the search process, the author focused on using the UK spelling and did not include the US spelling (for example: only "organisation" was search for, not "organization".) This decision could lead to potential limitations in the search outcome, as relevant results using US spelling might be missed. As language variations exist between different regions, many publications and sources might use either spelling interchangeably. Consequently, by restricting the search to more than one spelling variant, valuable and relevant information from sources employing the other variant could be noticed. To ensure a comprehensive and thorough search, it is advisable to consider both spellings during the search process in the future. This approach would broaden the scope of potential results and enhance the accuracy and completeness of the research findings, especially when exploring a subject that could be represented differently in various English-speaking regions.

5.4. Conclusions

This research focuses on examining the influence of Blockchain Technology (BCT) and its associated attributes on trust within container supply chains. Firstly, the study provides an overview of container supply chains, specifically highlighting the business process involving containers at ports, as well as an explanation of BCT's operational principles. Subsequently, the study identifies the factors that impact trust between BCT and container supply chains.

BCT has been successfully implemented in various sectors such as finance, healthcare, social governance, and agriculture. Consequently, it possesses the potential for effective application and commercial viability within the specific context of container supply chains. The unique technical characteristics of BCT have the capacity to transform trust-building processes within the current container supply chain significantly.

However, challenges exist in the practical implementation of BCT technology, and the acceptance of new technologies by organisations and society still requires substantial improvement. Nonetheless, researcher generally hold an optimistic view regarding the future application of BCT technology within commercial domains, thanks to its distinctive features. Yet, there remains a considerable journey ahead in terms of generating tangible business value for organisations.

Overall, this study underscores the significance of BCT and its potential to revolutionise trust dynamics within container supply chains. While obstacles and areas for improvement persist, the positive outlook among researcher highlights the promising prospects for BCT's commercial utilisation.

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Appendix

Table of selected articles for SLR

Name of authors	Title	Year	DOI

Ahmad, Raja Wasim; Hasan, Haya; Jayaraman, Raja; Salah, Khaled; Omar, Mohammed	Blockchain applications and architectures for port operations and logistics management	2021	10.1016/j.rtbm.2021.100620
Al-Rakhami, M.S.; Al-Mashari, M.	ProChain: Provenance-Aware Traceability Framework for IoT-Based Supply Chain Systems	2022	10.1109/ACCESS.2021.3135371
Ar, Ilker Murat; Erol, Ismail; Peker, Iskender; Ozdemir, Ali Ihsan; Medeni, Tunc Durmus; Medeni, Ihsan Tolga	Evaluating the feasibility of blockchain in logistics operations: A decision framework	2020	10.1016/j.eswa.2020.113543
Astarita, V.; Giofrè, V.P.; Mirabelli, G.; Solina, V.	A Review of Blockchain-Based Systems in Transportation	2020	10.3390/info11010021
Bader, L.; Pennekamp, J.; Matzutt, R.; Hedderich, D.; Kowalski, M.; Lücken, V.; Wehrle, K.	Blockchain-based privacy preservation for supply chains supporting lightweight multi-hop information accountability	2021	-
Bai, Yuhan; Fan, Kai; Zhang, Kuan; Cheng, Xiaochun; Li, Hui; Yang, Yintang	Blockchain-based trust management for agricultural green supply: A game theoretic approach	2021	10.1016/j.jclepro.2021.127407
Behnke, K.; Janssen, M.F.W.H.A.	Boundary conditions for traceability in food supply chains using blockchain technology	2020	10.1016/j.ijinfomgt.2019.05.025

Berneis, M.; Winkler, H.	Value Proposition Assessment of Blockchain Technology for Luxury, Food, and Healthcare Supply Chains	2021	10.3390/logistics5040085
Brookbanks, M.; Parry, G.	The impact of a blockchain platform on trust in established relationships: a case study of wine supply chains	2022	10.1108/SCM-05-2021-0227
Chang, S.E.; Chen, Y.	When blockchain meets supply chain: A systematic literature review on current development and potential applications	2020	10.1109/ACCESS.2020.2983601
Cheung, K.-F.; Bell, M.G.H.; Bhattacharjya, J.	Cybersecurity in logistics and supply chain management: An overview and future research directions	2021	10.1016/j.tre.2020.102217
Cocco, L.; Mannaro, K.; Tonelli, R.; Mariani, L.; Lodi, M.B.; Melis, A.; Simone, M.; Fanti, A.	A Blockchain-Based Traceability System in Agri-Food SME: Case Study of a Traditional Bakery	2021	10.1109/ACCESS.2021.3074874
Dong, L.; Zhao, J.; Chen, T.; Yu, Y.; Duan, Z.; Zhu, J.	The Secure Data Sharing and Interchange Model Based on Blockchain for Single Window in Trade Facilitation	2022	10.1109/ICBCTIS55569.2022.00041

Duran, C.A.; Fernandez-Campusano, C.; Carrasco, R.; Vargas, M.; Navarrete, A.	Boosting the Decision-Making in Smart Ports by Using Blockchain	2021	10.1109/ACCESS.2021.3112899
Dutta, P.; Choi, T.-M.; Somani, S.; Butala, R.	Blockchain technology in supply chain operations: Applications, challenges and research opportunities	2020	10.1016/j.tre.2020.102067
Dwivedi, Sanjeev Kumar; Amin, Ruhul; Vollala, Satyanarayana	Blockchain based secured information sharing protocol in supply chain management system with key distribution mechanism	2020	10.1016/j.jisa.2020.102554
Epiphaniou, G.; Pillai, P.; Bottarelli, M.; Al-Khateeb, H.; Hammoudesh, M.; Maple, C.	Electronic Regulation of Data Sharing and Processing Using Smart Ledger Technologies for Supply-Chain Security	2020	10.1109/TEM.2020.2965991
Etemadi, N.; Borbon-Galvez, Y.; Strozzi, F.; Etemadi, T.	Supply chain disruption risk management with blockchain: A dynamic literature review	2021	10.3390/info12020070
Fernandez-Vazquez, S.; Rosillo, R.; de la Fuente, D.; Puente, J.	Blockchain in sustainable supply chain management: an application of the analytical hierarchical process (AHP) methodology	2022	10.1108/BPMJ-11-2021-0750

Gao, N.; Han, D.; Weng, T.-H.; Xia, B.; Li, D.; Castiglione, A.; Li, K.-C.	Modeling and analysis of port supply chain system based on Fabric blockchain	2022	10.1016/j.cie.2022.108527
Garrard, Robert; Fielke, Simon	Blockchain for trustworthy provenances: A case study in the Australian aquaculture industry	2020	10.1016/j.techsoc.2020.101298
Ghode, D.; Yadav, V.; Jain, R.; Soni, G.	Adoption of blockchain in supply chain: an analysis of influencing factors	2020	10.1108/JEIM-07-2019-0186
Guggenberger, T.; Schweizer, A.; Urbach, N.	Improving Interorganizational Information Sharing for Vendor Managed Inventory: Toward a Decentralized Information Hub Using Blockchain Technology	2020	10.1109/TEM.2020.2978628
Härting, Ralf-Christian; Sprengel, Alexander; Wottle, Katja; Rettenmaier, Julia	Potentials of Blockchain Technologies in Supply Chain Management - A Conceptual Model	2020	10.1016/j.procs.2020.09.334
Hasan, Haya; AlHadhrami, Esra; AlDhaheri, Alia; Salah, Khaled; Jayaraman, Raja	Smart contract-based approach for efficient shipment management	2019	10.1016/j.cie.2019.07.022
Hellani, H.; Sliman, L.; Samhat, A.E.; Exposito, E.	On Blockchain Integration with Supply Chain: Overview on Data Transparency	2021	10.3390/logistics5030046

Hongmei, Z.	A Cross-Border E-Commerce Approach Based on Blockchain Technology	2021	10.1155/2021/2006082
Hu, Sensen; Huang, Shan; Huang, Jing; Su, Jiafu	Blockchain and edge computing technology enabling organic agricultural supply chain: A framework solution to trust crisis	2021	10.1016/j.cie.2020.107079
Huang, L.; Han, Y.; Yuan, A.; Xiao, T.; Wang, L.; Yu, Y.; Zhang, X.; Zhan, H.; Zhu, H.	New Business Form of Smart Supply Chain Management Based on "internet of Things + Blockchain"	2022	10.1155/2022/1724029
Irannezhad, E.	The Architectural Design Requirements of a Blockchain-Based Port Community System	2020	10.3390/logistics4040030
Jiang, Rong; Kang, Yuanjie; Liu, Yongsong; Liang, Zhihong; Duan, Yunlong; Sun, Yani; Liu, Jialan	A trust transitivity model of small and medium-sized manufacturing enterprises under blockchain-based supply chain finance	2022	10.1016/j.ijpe.2022.108469
Jo, Jisung; Yi, Sanghyuk; Lee, Eon-kyung	Including the reefer chain into genuine beef cold chain architecture based on blockchain technology	2022	10.1016/j.jclepro.2022.132646
Juma, H.; Shaalan, K.; Kamel, I.	A Survey on Using Blockchain in Trade Supply Chain Solutions	2019	10.1109/ACCESS.2019.2960542

Kamble, S.; Gunasekaran, A.; Arha, H.	Understanding the Blockchain technology adoption in supply chains-Indian context	2019	10.1080/00207543.2018.1518610
Kamble, Sachin S.; Gunasekaran, Angappa; Sharma, Rohit	Modeling the blockchain enabled traceability in agriculture supply chain	2020	-
Karakas, S.; Acar, A.Z.; Kucukaltan, B.	Blockchain adoption in logistics and supply chain: a literature review and research agenda	2021	10.1080/00207543.2021.2012613
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