



# Optimizing Vietnam's Logistics Industry: Leveraging Blockchain Technology for Supply Chain Management

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**Abstract.** This paper investigates the role of blockchain technology in decentralized data storage and its relevance to sustainable logistics and supply chain management. With its ability to ensure transparency and streamline information flows, blockchain is increasingly recognized as a catalyst for digital transformation in the logistics industry, particularly within the context of Industry 4.0. Although blockchain is traditionally linked to financial services, its application in logistics helps address critical challenges such as shipment delays and inaccurate data exchange. Through a qualitative analysis, the study highlights growing international interest in applying blockchain for activities like product traceability and improving data security. Nevertheless, the adoption of blockchain in Vietnam's logistics sector remains at an early stage. In response, the article proposes targeted strategies to accelerate the integration of blockchain into logistics operations in the country.

**Keywords:** blockchain; logistics; internet of things; big data

## 1 Introduction

Logistics is no longer just a supporting function in the production and supply chain but has become a strategic component that directly influences business success in today's competitive environment. Efficient logistics operations enable firms to respond swiftly to market demands, ensuring timely and accurate delivery of goods and services (Pečený et al., 2020). This contributes to customer satisfaction, strengthens brand credibility, and fosters lasting customer relationships. In the digital age, integrating advanced technologies into logistics is not only a prevailing trend but also a critical factor that enhances business agility and competitiveness (Lim et al., 2021).

Emerging research highlights the transformative potential of blockchain in improving transparency and data integrity. When applied to logistics, blockchain can record transportation-related information in a secure and tamper-proof manner, reducing the risk of fraud and enhancing trust across supply chain stakeholders (Sengupta, 2021). From warehousing and delivery to payment processing, blockchain facilitates end-to-end visibility and operational efficiency. Moreover, it can speed up the movement of goods while ensuring transparency, which ultimately improves customer satisfaction (Lindman, 2017). Beyond enhancing existing processes, blockchain also opens doors to innovative logistics services. Nevertheless, as a

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relatively new technology, blockchain adoption still encounters various limitations and implementation challenges (Berke, 2018).

In the context of Vietnam, the integration of blockchain into logistics remains in its infancy. Despite the potential, many logistics service providers still rely on basic technologies such as customs clearance software, vehicle GPS tracking, email, and internet tools. The level of technological adoption remains modest, and significant efforts are needed to advance toward digital transformation. This paper, therefore, explores the practical applications of blockchain in logistics and proposes strategic solutions to enhance its implementation in Vietnam's logistics sector.

## 2 Research method

### 2.1 Objectives

The objective of this study is to evaluate the applications of blockchain technology in supply chain management and logistics in Vietnam by analyzing qualitative data from existing literature and case studies. The aim is to provide insights into how blockchain can address current challenges in this sector.

### 2.2 Methodology

This research adopts a qualitative approach, focusing on the collection and analysis of secondary data from existing academic and industry literature, reports, and case studies related to blockchain applications in logistics.

### 2.3 Data Collection

The data for this study was collected from various sources, including:

**Academic Journals:** Peer-reviewed articles that discuss blockchain technology in supply chain management and logistics.

**Industry Reports:** Publications from industry bodies, consultancy firms, and market research companies that provide insights into the practical applications and benefits of blockchain in logistics.

**Case Studies:** Detailed descriptions of specific instances where blockchain has been implemented in logistics, highlighting the challenges, solutions, and outcomes.

**Data Sources:** Google Scholar and other academic databases for journal articles; Websites of industry organizations and consultancy firms for reports; mOnline repositories and company websites for case studies

### 2.4 Data Analysis

The collected data will be analyzed using a thematic analysis approach. This involves identifying, analyzing, and reporting patterns (themes) within the data. The steps in the thematic analysis process include:

*Familiarization with Data:* Reading and re-reading the collected documents to become familiar with the content.

*Generating Initial Codes:* Identifying and noting down key points and recurring concepts related to the application of blockchain in logistics.

*Searching for Themes:* Grouping the initial codes into broader themes that represent significant aspects of the data.

*Reviewing Themes:* Refining the themes to ensure they accurately reflect the data and are relevant to the research objectives.

*Defining and Naming Themes:* Providing clear definitions and names for each theme to ensure clarity and coherence in the analysis.

*Writing the Report:* Integrating the themes into a comprehensive narrative that addresses the research questions and objectives.

## 2.5 Expected Outcomes

Although the study does not include primary data collection, practical insights are derived from Vietnamese logistics practices, industry reports (e.g., VLA 2023 white paper), and selected company initiatives such as Viettel Post and VNPost digitalization efforts. The analysis is expected to yield several key insights, including:

*Identified Benefits:* Understanding the specific benefits of blockchain technology in logistics, such as improved transparency, reduced fraud, and enhanced efficiency.

*Challenges and Barriers:* Highlighting the challenges and barriers to blockchain adoption in logistics, including technical, regulatory, and organizational issues.

*Best Practices:* Identifying best practices and successful strategies for implementing blockchain in logistics based on case study examples.

*Future Trends:* Providing insights into future trends and potential developments in the application of blockchain technology in the logistics sector.

## 2.6 Challenges and Limitations

While this study aims to provide valuable insights, there are potential challenges and limitations to consider:

*Data Availability:* Limited availability of detailed case studies and industry reports specific to the Vietnamese logistics sector.

*Subjectivity:* The qualitative nature of the analysis may introduce subjective interpretations of the data.

*Rapid Technological Change:* The fast-paced development of blockchain technology may result in new applications and challenges that are not covered in the existing literature.

By conducting this qualitative analysis, this study seeks to contribute to the understanding of blockchain technology's potential in the logistics sector and provide a foundation for further research and practical applications in Vietnam.

## 2.7 Research Questions and Conceptual Framework

To complement the qualitative methodology presented above, this study also outlines two guiding research questions to clarify the scope of inquiry:

RQ1: How can blockchain technology address key inefficiencies in Vietnam's logistics and supply chain operations?

RQ2: What are the major barriers and enabling conditions for blockchain adoption in Vietnam's logistics sector?

These questions are aligned with two exploratory hypotheses:

H1: The application of blockchain technology improves logistics performance through enhanced transparency, traceability, and transaction security.

H2: The lack of technical infrastructure, high implementation costs, and limited awareness are the main challenges facing blockchain deployment in Vietnam's logistics industry.

These hypotheses provide a conceptual lens through which the thematic analysis is conducted. While the study is qualitative and based on secondary data, these hypotheses help focus the interpretation of findings and identify directions for future empirical research.

## 3 Results and discussions

### 3.1 Literature Review

The body of research examining blockchain technology in the logistics sector is gradually expanding both globally and within Vietnam. However, domestic studies remain at a foundational level, primarily focusing on introductory concepts. For example, Ho Thi Thu Hoa and Bui Thi Bich Lien (2018) analyzed the theoretical potential of blockchain in enhancing supply chain transparency and traceability, while reducing reliance on intermediaries. They emphasized that blockchain enables detailed tracking of delivery routes, timelines, and sources of disruption or damaged goods. Their study also stressed the importance of cultivating a collaborative business culture and raising awareness of blockchain to support its adoption in Vietnam.

Nguyen Thi Hong Van (2020) investigated the role of blockchain in Vietnam's agricultural supply chains. While noting the global momentum behind the technology, she pointed out that even major international companies—such as IBM, Samsung, and Walmart—were still in the early stages of exploring blockchain. Her research emphasized the necessity of governmental engagement and institutional backing to facilitate broader implementation in Vietnam's logistics landscape.

From an international perspective, Kühn et al. (2019) applied the Technology-Organization-Environment (TOE) framework to assess blockchain usage among logistics providers in Germany. Their findings revealed that while large companies had begun launching pilot blockchain projects, small and medium enterprises (SMEs) remained hesitant due to high risk perception and a lack of familiarity with the technology. Although the study was limited in scope, it highlighted organizational constraints even in technologically advanced economies.

Meanwhile, research by Miraz et al. (2019), based on the Unified Theory of Acceptance and Use of Technology (UTAUT), evaluated blockchain's impact on logistics efficiency in Malaysia. The study showed that blockchain contributed to improved supply chain performance through better IT systems, workforce productivity, and digital logistics operations. These findings are particularly relevant to developing countries like Vietnam, which share similar technological and institutional challenges.

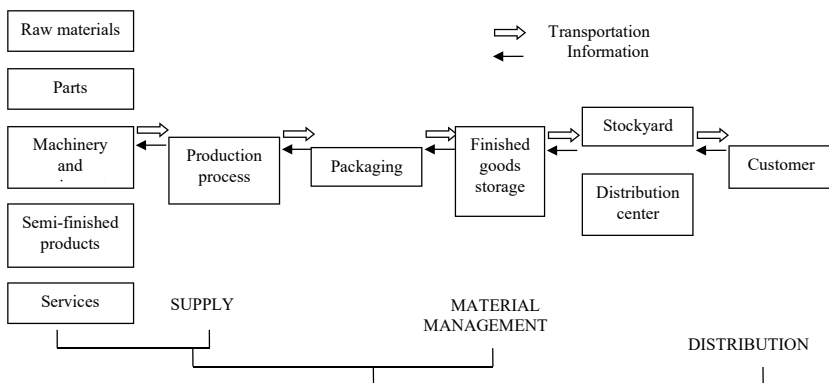
Real-world case studies further illustrate blockchain's practical value. In 2017, IBM and Maersk conducted a pilot that digitized paperwork and enhanced visibility in container shipping, streamlining logistics processes. In the retail sector, Walmart's partnership with IBM enabled real-time tracking of food origins, significantly

improving response time during contamination incidents and reducing food waste. Such cases demonstrate the broad applicability of blockchain across global logistics, from fraud reduction and customs efficiency to improved inventory accuracy.

These international experiences reinforce blockchain’s role as a versatile tool in modern supply chains. Whether through document digitization, automation via smart contracts, or enhanced end-to-end visibility, blockchain offers practical solutions to longstanding inefficiencies. For Vietnam, these examples offer critical lessons. If supported by appropriate infrastructure, policies, and public awareness, blockchain adoption in the Vietnamese logistics sector could address systemic challenges—such as fragmented supply chains, redundant paperwork, and lack of transparency—and pave the way for a more resilient and efficient logistics ecosystem.

### 3.2 An overview of logistics and blockchain in

#### 3.2.1 Logistics in Vietnam: Definitions and Key Challenges



**Figure 1:** Logistics Activities

*Source: Blaik, 2009 [3]*

Logistics is broadly defined as the process of planning, managing, and controlling the movement and storage of goods, services, and related information throughout the supply chain—from the acquisition of raw materials to the final delivery to end-users. It encompasses not only the flow of physical products but also the movement of information and financial resources between stakeholders (Li et al., 2020; DİNÇEL, 2023). Depending on the scope of operations, logistics services can be categorized into transportation-related activities, value-added services, and core logistics functions.

The logistics sector is a key driver of economic development, particularly in open and trade-oriented economies. For developing countries like Vietnam, logistics acts as a critical enabler of both domestic commerce and international trade. In 2019, Vietnam's merchandise export value reached approximately \$264.19 billion—equivalent to 40.8% of its GDP (based on purchasing power parity)—representing an 8.4% increase from 2018. Imports also saw steady growth, totaling \$253.07 billion, up by 6.8% from the previous year.

Despite these positive indicators, Vietnam's logistics sector continues to face substantial challenges. Operational inefficiencies persist due to outdated procedures, manual documentation, and a lack of coordination among actors in the supply chain. A standard cross-border logistics process often involves more than 10 different parties and an extensive exchange of paperwork. The duplication of documents for shipping, transport, and customs clearance not only delays processing times but also increases the likelihood of errors, miscommunication, and unnecessary costs. These delays can extend customs clearance by days or even weeks, leading to higher storage fees and in some cases, product spoilage or damage.

Improving the efficiency of logistics operations requires optimizing the coordination of goods, data, and financial flows throughout the transaction cycle. According to the Vietnam Logistics Business Association (VLA), the country is home to over 4,000 logistics and transportation enterprises. While this offers customers a wide range of options, the fragmentation of service providers results in inconsistent data sharing and limited supply chain visibility. This complexity increases the risk of misaligned handovers and disputes between parties. For instance, a refrigerated shipment from East Africa to Europe may require over 200 interactions among 30 different stakeholders, illustrating the operational challenges of modern logistics networks.

In Vietnam's context, the sector also contends with high logistics costs, estimated at 16.8% of GDP—significantly higher than the 8–10% typically observed in developed countries. The World Bank's 2023 Logistics Performance Index ranked Vietnam 64th globally, reflecting ongoing infrastructure bottlenecks and the slow pace of digital transformation. Addressing these issues is essential for enhancing competitiveness, reducing trade friction, and integrating more effectively into global value chains.

### **3.2.2 Blockchain Technology and Its Applications in Logistics**

Blockchain is a decentralized digital ledger technology that enables secure and tamper-resistant recording of transactions across a shared network. By distributing identical copies of data to multiple nodes, blockchain minimizes the need for intermediaries, facilitates trust among participants, and enhances data integrity (Kiickelhaus & Chung, 2018). Although originally associated with cryptocurrencies, blockchain's design—emphasizing transparency, immutability, and decentralization—makes it well-suited for broader applications across various industries, including logistics (Rodeck & Curry, 2022).

In the context of supply chain and logistics, blockchain has demonstrated considerable potential to streamline operations, improve traceability, and boost efficiency. A growing body of international research supports this view, showing that

blockchain can capture detailed transaction data at each stage of a product's lifecycle. This includes tracking the movement of goods, validating documentation such as receipts and shipping records, and managing digital assets like warranty certificates and compliance licenses (Dobrovnik et al., 2018; Gong & Liao, 2019; Kühn et al., 2019).

Several key benefits have emerged from practical blockchain applications in the logistics sector:

- **Reducing Intermediaries and Enhancing Automation:** By digitizing paperwork and removing redundant verification processes, blockchain enables faster and more cost-effective shipping. A notable example is the IBM-Maersk partnership, which launched a blockchain-based platform to digitize global shipping documentation. Their pilot project successfully replaced manual paperwork with shared digital records, enabling end-to-end container tracking and reducing customs delays (Alison, 2017).
- **Strengthening Data Security and Transparency:** Because blockchain data cannot be retroactively altered without consensus from the network, it provides a secure environment for trade-related information. Multiple parties can simultaneously access verified data, minimizing fraud and building trust among stakeholders. This is particularly valuable in multi-tiered supply chains where data fragmentation is common (Sengupta, 2021).
- **Smart Contracts for Automation:** Blockchain supports self-executing digital contracts that automatically fulfill agreed-upon terms. In logistics, this can streamline payment processing—once delivery is verified, payments are automatically released without manual intervention—reducing delays and operational friction (Abou Jaoude & George Saade, 2019).
- **Optimizing Document Handling:** Logistics chains generate significant amounts of documentation, much of which is repetitive and prone to loss or error. Blockchain's distributed database allows for secure, real-time access to shipment documents, reducing paperwork costs and increasing audit readiness. Research estimates that document processing can account for 15% to 50% of logistics costs (Groenfeldt, 2017; Popper & Lohr, 2017).
- **Improved Product Traceability:** Traceability is critical for responding to food safety or product recall incidents. Walmart's collaboration with IBM illustrates blockchain's power in this area. By recording supply chain data—such as farm origin, processing locations, and expiration dates—on a transparent ledger, Walmart reduced product trace times from days to seconds (Tian, 2016; Shaffer, 2017). This not only enhances food safety but also improves inventory management and reduces waste.

In Vietnam, blockchain adoption in logistics remains nascent but is gaining attention. Local initiatives by Viettel Post and VNPost have begun exploring blockchain-based systems for package traceability and digital authentication. According to reports from the Vietnam Logistics Business Association and national media, several small and medium-sized enterprises are piloting blockchain applications in warehouse management, real-time tracking, and digital documentation. These efforts, though limited in scale, indicate a growing awareness of blockchain's value for improving transparency and reducing operational bottlenecks in the domestic logistics industry.

### 3.3 Strategies to Promote Blockchain Adoption in Vietnam's Logistics Sector

The application of blockchain technology is widely recognized as a key enabler for transforming logistics operations, especially in the context of Industry 4.0. To effectively leverage its potential, Vietnam's logistics industry must address several strategic areas:

#### 1. Enhancing Awareness and Stakeholder Collaboration

As blockchain adoption expands across industries, inconsistent implementations and fragmented solutions have emerged, particularly due to varying technical standards and competing platforms. This heterogeneity can hinder system integration and reduce the technology's effectiveness in logistics. Raising awareness about blockchain's benefits—particularly in supply chain transparency, efficiency, and traceability—is essential. Targeted education and outreach programs should be introduced for logistics providers, SMEs, and public sector actors. Fostering a collaborative ecosystem will help align interests, support interoperability, and maximize shared value across the industry.

#### 2. Strengthening Technological Readiness and Infrastructure

One of the major bottlenecks in Vietnam's logistics sector lies in the lack of advanced digital infrastructure and inconsistent data integration between firms. This leads to delays, inefficiencies, and increased operational costs. To fully exploit blockchain's advantages—such as smart contracts and real-time asset tracking—firms need to invest in automation, cloud services, and secure data-sharing systems. Infrastructure upgrades should also prioritize stable connectivity and fast processing speeds to support blockchain platforms. In this regard, public-private partnerships may help ease the financial burden for logistics enterprises.

#### 3. Establishing a Supportive Policy and Regulatory Framework

The successful implementation of blockchain in logistics also requires an enabling legal environment. At present, there is a lack of standardized procedures and official guidance for deploying blockchain-based systems in Vietnam's logistics sector. Government involvement is therefore vital. Policymakers should focus on simplifying administrative procedures through blockchain integration and develop clear regulations on data usage, digital contracts, and interoperability standards. Pilot programs can serve as testbeds to evaluate policy efficiency and scalability.

Furthermore, the establishment of logistics hubs and digital goods verification centers can complement blockchain deployment by improving transparency and reducing redundancies in cargo handling and documentation. These initiatives should be accompanied by capacity-building programs to train logistics staff in blockchain operations and cybersecurity.

### 3.4 Practical Initiatives of Blockchain Adoption in Vietnam's Logistics Sector

In recent years, although the implementation of blockchain in Vietnam's logistics industry remains at an early stage, several concrete initiatives by both government agencies and private enterprises have demonstrated its practical potential.

#### Blockchain-based parcel tracking by Viettel Post:

In 2021, Viettel Post—one of Vietnam's leading logistics service providers—launched a pilot program integrating blockchain technology into its parcel tracking system. The initiative focused on enhancing the transparency and traceability of last-mile deliveries. By using a distributed ledger system, the company was able to reduce incidents of lost parcels and increase customer trust through more accurate delivery updates. Although still in a trial phase, this marked one of the first efforts by a major Vietnamese logistics firm to incorporate blockchain into operational processes.

#### Agricultural product traceability by Vietnam Blockchain Corporation”

Vietnam Blockchain Corporation (VBC) has collaborated with local agricultural cooperatives to implement blockchain-based tracking systems for export-oriented produce, such as dragon fruit and mango. In Long An province, these systems utilize QR codes embedded with blockchain data to document every stage of the supply chain—from cultivation and harvesting to packaging and distribution. This digital traceability has improved consumer confidence and helped Vietnamese exporters comply with the rigorous traceability standards set by international markets, including the European Union and Japan.

#### Government initiatives and sectoral outlook”

The Vietnam Logistics Business Association (VLA) has identified blockchain as a key pillar in the sector's digital transformation roadmap through 2025. In response, several awareness programs, conferences, and pilot initiatives have been launched with the backing of the Ministry of Industry and Trade (MOIT) and the Ministry of Science and Technology (MOST). These programs aim to raise awareness, foster innovation, and support small and medium-sized logistics firms in exploring blockchain applications. Together, these early-stage efforts highlight blockchain's growing relevance in Vietnam's logistics landscape. While the scale remains modest, the emerging ecosystem—supported by policy direction and technological experimentation—suggests that blockchain has the potential to become a mainstream tool for boosting efficiency, transparency, and competitiveness in the country's supply chain operations.

## 4. Conclusion

Drawing on insights from prior studies, several key takeaways can be identified concerning both the potential benefits and limitations of blockchain implementation in logistics. This technology shows significant promise in streamlining various logistics processes—such as tracking shipments, managing order updates, handling shipping documents, and enhancing information flow across the production and distribution chain.

What distinguishes blockchain from earlier digital solutions is its unique combination of transparency, data integrity, and decentralization. These characteristics make it especially valuable in promoting operational efficiency, trust, and sustainability across supply chain systems—for logistics service providers, shippers, and regulatory bodies alike [10].

Looking ahead, more empirical research is needed to evaluate the practical outcomes of blockchain deployment in real-world logistics settings. Future studies could examine

implementation models, performance metrics, and comparative impacts across different types of logistics networks. Additionally, several challenges—such as the readiness of digital infrastructure, concerns over data privacy and competitive intelligence, protocols for secure data storage, and the absence of a well-defined legal framework—remain critical areas for further investigation and policy development.

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