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Application Of Blockchain Technology in Vietnamese Logistics Enterprises: Current Situation and Solutions

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Abstract:
Blockchain technology has revolutionized various industries and sectors, including the logistics industry. This article provides an overview of the theoretical foundations of blockchain technology and analyzes the current state of its application in logistics service enterprises in Vietnam. It also examines the benefits and challenges associated with the adoption of this technology in the logistics sector. Based on these insights, the article proposes several solutions to promote the development and broader application of blockchain in this field in Vietnam.
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I. INTRODUCTION

In recent years, blockchain has been recognized as one of the most promising technologies, capable of bringing significant changes to the operations of companies, organizations, and governments. A large number of blockchain based applications have been developed across various sectors, including e-government, finance, education, logistics, and supply chain management. Blockchain technology is considered a key enabler of the Fourth Industrial Revolution, offering enhanced transparency, security, and efficiency to supply chains. In the logistics industry - an area that is particularly dependent on data and cross-sectoral coordination - blockchain holds great potential to reshape management and operational practices. However, in Vietnam, the implementation of this technology still faces several barriers, particularly among logistics enterprises. This paper analyzes the current state of blockchain adoption in Vietnam's logistics sector, examines the challenges faced by logistics service providers, and proposes recommendations to foster the broader application of blockchain in business logistics operations.

II. THEORETICAL FOUNDATIONS OF BLOCKCHAIN

2.1. Concept

Blockchain is a decentralized database that stores information linked together through encryption and is capable of expanding over time. These blocks of information function independently and chronologically. What makes blockchain unique is that it is managed by participants within the system rather than through any intermediary (Abou Jaoude & George Saade, 2019).

According to Tapscott, D. & Tapscott, A. (2016), 'Blockchain is a technology that creates transparency in all digital transactions, helping to build a new economic system in which people can exchange value without relying on trusted intermediaries.' This highlights blockchain as a transformative technology for the global economy, offering a transparent and trustworthy platform for all transactions.

Blockchain technology is defined as a method of storing and transmitting information based on blocks that are linked together and expand sequentially over time (Huckle et al., 2016). Each block in the chain contains information about its time of creation and is cryptographically linked to the preceding block. One of the fundamental characteristics of blockchain is its resistance to the alteration of recorded data (Ge et al., 2017).

2.2. Characteristics of Blockchain Technology

Blockchain is a decentralized and highly secure technology used for storing and transmitting data across a peer-to-peer network. Its key features include:

- Decentralization: Blockchain does not rely on a centralized database; instead, data is distributed across numerous nodes in the network. Each node maintains a complete copy of the entire blockchain ledger.
- Security: Blockchain employs cryptographic techniques to protect data. Each block is linked to its predecessor through a cryptographic hash function, forming a chain that is resistant to tampering. Any modification to a block alters its hash, disrupting the chain and making unauthorized changes easily detectable.

- Transparency and privacy: Blockchain allows all network participants to view and verify data, though they cannot alter it. Personal and transactional information can be protected through encryption and authentication methods.
- Immutability: Once data is recorded on the blockchain, it cannot be altered or deleted. This ensures a high level of data integrity and trustworthiness.
- Trustless transactions: Blockchain enables parties to conduct transactions directly without relying on intermediaries such as banks or exchanges. This reduces transaction costs and time, while enhancing transparency.
- Smart contracts: These are self-executing programs that automatically enforce contractual terms, reducing the need for intermediaries and increasing automation in business processes.

III. THE BENEFITS OF APPLYING BLOCKCHAIN TECHNOLOGY IN THE LOGISTICS SECTOR

Blockchain technology in logistics is not merely a "technological component" but plays a crucial role in reshaping business strategies. First and foremost, it enhances transparency and trust. In traditional supply chains, data is often fragmented, difficult to reconcile, and prone to discrepancies. Blockchain transforms this reality: every transaction is recorded immutably and publicly, allowing participants to verify its accuracy. Customers, manufacturers, retailers, and customs authorities can track the status of goods, origin, transit times, and quality inspections through the blockchain. This builds trust, improves service quality, and reduces the risk of fraud. The application of blockchain technology in logistics clearly offers significant advantages, especially in an environment demanding greater transparency, faster operations, and cost optimization. Key benefits include:

- **Enhanced transparency and traceability**

In logistics supply chains, quality control and traceability are vital, particularly for food, pharmaceuticals, and export goods. Blockchain establishes an immutable data system where all transactions (e.g., pickup points, quality checks, deliveries) are chronologically recorded. This enables both businesses and customers to trace the full lifecycle of products, preventing fraud and counterfeiting - especially in cross-border trade. It also supports compliance with international regulations such as FDA, ISO, and HACCP.

- **Improved data security**

Blockchain utilizes advanced cryptographic techniques (e.g., hashing, digital signatures) and distributes data across numerous network nodes. This decentralized design ensures that no single party can alter data undetected, thereby minimizing the risk of cyberattacks or internal breaches - especially important for sensitive documents like shipping records, contracts, and customer information.

- **Reduced operational costs through disintermediation**

Smart contracts enable automation of processes such as automatic payments upon successful delivery and verification of documents (e.g., bills of lading, invoices) without requiring third-party confirmation. This helps reduce transaction, banking, and auditing fees while also shortening processing times and accelerating supply chain operations.

- **Optimized logistics processes and greater efficiency**

When combined with the Internet of Things (IoT), blockchain allows companies to monitor product conditions (e.g., temperature, location) in real time and log the data immutably. This facilitates alerts in case of anomalies (e.g., loss of cold-chain temperature), enables automatic inventory updates, coordinates transportation more efficiently, and reduces delivery delays.

- **Strengthened trust across the logistics ecosystem**

Logistics companies must collaborate with various stakeholders such as suppliers, ports, transport firms, insurers, and banks. Blockchain offers a transparent, decentralized platform that reduces data conflicts and fosters collaboration by allowing all parties access to a shared, tamper-proof record.

- **Support for sustainable development and global integration**

Many developed markets now mandate transparent traceability - especially for agricultural products, seafood, and textiles. Blockchain helps businesses meet ESG (Environmental, Social, Governance) standards, enhances competitiveness, facilitates international market entry, and avoids non-tariff technical barriers.

IV. THE CURRENT SITUATION OF BLOCKCHAIN TECHNOLOGY ADOPTION IN LOGISTICS ENTERPRISES IN VIETNAM

Currently, blockchain technology is gradually being adopted in Vietnam's logistics service industry, primarily by large enterprises. Approximately 10-15% of companies have experimented with or implemented blockchain in specific operations, such as goods tracking, document management, and smart contracts. In contrast, small and medium-sized enterprises (SMEs) remain cautious due to limitations in financial and human resources. Notable companies such as VNL, Sapo Logistics, and BHL Logistics have initially adopted blockchain to enhance transparency, strengthen data security, and reduce fraud and operational costs. The reported adoption rate of 10-

15% reflects a modest level of engagement, with applications largely limited to specific processes rather than comprehensive system integration. Common applications include:

- Goods tracking: Utilizing blockchain to record the movement of goods from origin to destination, enabling accurate traceability.
- Document management**:** Storing and verifying transportation documents (e.g., invoices, receipts, certificates of origin/conformity) on blockchain platforms to prevent forgery and loss.
- Smart contracts: Automating contractual terms between parties, such as triggering payments once delivery is confirmed.

Overall, the application of blockchain technology in Vietnam's logistics enterprises remains in a trial and limited deployment phase. As most logistics firms in Vietnam are SMEs, they often lack the financial and human capital required for full-scale implementation, despite the potential benefits. Consequently, many companies continue to focus on more conventional technologies such as Warehouse Management Systems (WMS), Transportation Management Systems (TMS), and other tools aimed at improving basic operational efficiency.

V. CHALLENGES IN THE ADOPTION OF BLOCKCHAIN TECHNOLOGY IN LOGISTICS ENTERPRISES IN VIETNAM

The adoption of blockchain technology in logistics enterprises in Vietnam remains limited due to several challenges:

First, there is the challenge of high initial investment costs. Implementing a blockchain system requires substantial capital for technological infrastructure, including software, servers, security systems, and highly skilled personnel. Additionally, integrating blockchain into existing systems - such as warehouse management systems (WMS), transportation management systems (TMS), or enterprise resource planning (ERP) - incurs significant costs. This poses particular difficulties for small and medium-sized enterprises (SMEs), which make up the majority of the logistics sector in Vietnam and often face constraints in technology budgets.

Second, the lack of a clear legal framework and technical standards is a major obstacle. In Vietnam, blockchain applications still lack a well-defined regulatory environment. Legal provisions related to smart contracts, the legitimacy of distributed data storage, and the resolution of blockchain - related disputes are either absent or inconsistent. This legal ambiguity fosters a "wait-and-see" attitude among businesses, as they are concerned about potential legal risks associated with adopting unregulated technologies.

Third, there are integration challenges with existing systems. Most logistics enterprises in Vietnam still operate on traditional, centralized management systems tailored to specific operational needs. Integrating a decentralized technology such as blockchain into these systems requires fundamental changes to data structures, operational workflows, and even organizational culture. Without a well-planned approach, such integration can be technically complex and operationally disruptive.

Fourth, there is a shortage of qualified blockchain professionals. One of the most pressing issues is the limited availability of skilled personnel who possess both technical expertise in blockchain and industry knowledge in logistics. Educational institutions and training programs have not yet caught up with the demand from the market. Recruiting or internally training such talent is both time - consuming and costly, which hinders effective and large-scale implementation.

Fifth, awareness remains limited, and there is a strong resistance to change. Many logistics companies in Vietnam lack a full understanding of blockchain's nature and its potential benefits. Some continue to associate blockchain solely with cryptocurrencies or view it as carrying financial risks. The fear of digital transformation, coupled with satisfaction with legacy systems, reduces motivation to embrace new technologies.

Sixth, data standardization and supply chain synchronization pose further challenges. Blockchain's effectiveness depends on the participation and data-sharing of all supply chain stakeholders - including suppliers, carriers, warehouses, ports, and customers. However, in Vietnam, logistics data is still fragmented, unstandardized, and largely siloed. Connecting these entities on a shared blockchain platform requires not only technical infrastructure but also alignment in processes, data access permissions, and information - sharing protocols.

VI. PROPOSED SOLUTIONS TO ENHANCE THE ADOPTION OF BLOCKCHAIN TECHNOLOGY IN VIETNAM'S LOGISTICS INDUSTRY

Although blockchain offers significant potential for the logistics sector, its effective implementation in Vietnam requires a systematic approach supported by clearly defined policies and practical solutions. Several specific measures include:

First, developing a comprehensive legal framework and national technical standards: To enable the robust development of blockchain in logistics, clear legal regulations and technical standards are essential for businesses to comply with and to ensure security in the use of this technology. Establishing such standards is critical to ensuring blockchain can be deployed effectively and sustainably in Vietnam's logistics industry.

Blockchain requires a well-defined legal framework to protect stakeholder rights, ensure transparency, and comply with regulations on security, privacy, and data protection. There is a pressing need to legally recognize smart contracts and digital transactions on blockchain platforms, particularly in areas such as payments, electronic bill of lading verification, and product traceability. Legal sandbox models should be piloted in major seaports and industrial zones to assess risks and refine the legal framework.

Second, enabling businesses to access Blockchain-as-a-Service (BaaS) to reduce initial investment costs: The government can support the development of BaaS platforms operated by major domestic tech enterprises (e.g., FPT, Viettel). Logistics companies, especially small and medium-sized enterprises (SMEs), could rent blockchain services as a platform instead of investing in full infrastructure, making adoption more feasible. Priority tax incentives should be offered to businesses using digital technology services, particularly during the pilot phase.

Third, promoting joint ventures and collaboration among logistics enterprises to build a shared blockchain-based ecosystem: Forming technology alliances among transporters, warehouse operators, seaports, and freight forwarders should be encouraged to facilitate cost and data sharing. A multi-enterprise blockchain platform should be established, where each party acts as a network node, jointly validating and tracing supply chain data. Local business clusters (e.g., Cat Lai, Hai Phong, Da Nang) should be supported in piloting region-based blockchain ecosystems.

Fourth, standardizing inter-sectoral logistics data and processes to facilitate blockchain synchronization across the supply chain: A set of unified logistics data standards (e.g., shipment code formats, warehouse codes, traceability information) should be issued to support data integration into blockchain platforms. The broader use of internationally recognized identifiers (such as GS1, QR codes, RFID) should be promoted to ensure cross-border interoperability. All logistics operations—from order processing to transportation, warehousing, and delivery—should be digitized to generate clean input data for blockchain systems.

Fifth, enhancing training and raising awareness of blockchain technology: Logistics companies should invest in workforce training to build a foundational understanding of blockchain and its practical implications for the industry. Specialized training programs that integrate theory and practice should be developed. Collaborations with universities and research institutes are essential to produce dual-skilled professionals in blockchain technology and logistics operations. Additionally, communication campaigns, industry seminars, and forums should be expanded to eliminate misconceptions and build confidence in the practical value of blockchain.

A coordinated implementation of these solutions will not only help overcome current barriers but also lay the groundwork for the comprehensive digital transformation of Vietnam's logistics sector, thereby enhancing competitiveness and facilitating deeper, more transparent, efficient, and sustainable integration into global supply chains.

VII. CONCLUSION

The application of blockchain technology in Vietnam’s logistics sector presents significant potential, particularly in enhancing transparency, data security, and operational efficiency throughout the supply chain. However, its implementation still faces various obstacles, including high initial investment costs, the absence of a clear legal framework, limited technical capabilities, and a general lack of awareness among stakeholders. To effectively harness the value of blockchain, close collaboration among the government, enterprises, and educational institutions is essential in developing supportive policies, refining institutional frameworks, and strengthening human resource capacity. The implementation of pilot programs, standardization of logistics data, and encouragement of joint ventures will serve as foundational measures to promote sustainable development. In the face of increasingly intense global competition, blockchain is not merely a technological trend but a strategic solution that can accelerate the alignment of Vietnam’s logistics industry with international standards. With targeted investment, blockchain has the potential to become a key pillar in the digital transformation process and a critical driver of the sector’s long-term competitiveness.

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