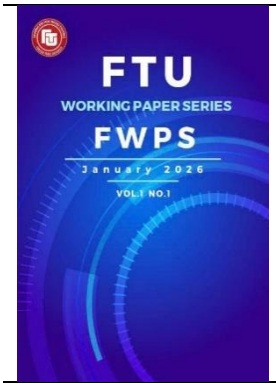

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TĂNG CƯỜNG MINH BẠCH CHUỖI CUNG ỨNG THÔNG QUA CÔNG NGHỆ BLOCKCHAIN: NGHIÊN CỨU TRƯỜNG HỢP WALMART VÀ BÀI HỌC CHO NGÀNH BÁN LẺ TẠI VIỆT NAM

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Tóm tắt

Trong bối cảnh nhu cầu minh bạch chuỗi cung ứng và an toàn thực phẩm ngày càng gia tăng, nghiên cứu này phân tích việc ứng dụng công nghệ blockchain trong nâng cao minh bạch chuỗi cung ứng thông qua trường hợp Walmart. Nghiên cứu tập trung làm rõ cách Walmart triển khai blockchain trong truy xuất nguồn gốc thực phẩm, đánh giá hiệu quả đạt được và tác động tới cơ chế phối hợp giữa các bên liên quan. Kết quả nổi bật cho thấy blockchain giúp rút ngắn thời gian truy xuất, nâng cao độ tin cậy dữ liệu, tăng cường giám sát an toàn thực phẩm và thúc đẩy hợp tác giữa các nhà cung ứng. Từ đó, nghiên cứu chỉ ra các hạn chế của chuỗi cung ứng bán lẻ Việt Nam và đề xuất khuyến nghị phù hợp giúp doanh nghiệp triển khai blockchain nhằm nâng cao năng lực truy xuất và củng cố niềm tin người tiêu dùng.

Từ khóa: blockchain, minh bạch chuỗi cung ứng, truy xuất nguồn gốc, bán lẻ, Walmart

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ENHANCING SUPPLY CHAIN TRANSPARENCY THROUGH BLOCKCHAIN: A CASE STUDY OF WALMART AND LESSONS FOR RETAIL INDUSTRY IN VIETNAM

Abstract

In the context of growing demand for supply chain transparency and food safety, this study examines the application of blockchain technology to enhance supply chain transparency through the case of Walmart. The research analyzes how Walmart implemented blockchain for food traceability, evaluates its effectiveness, and explores changes in coordination among supply chain actors. The findings show that blockchain significantly reduced traceability time, improved data reliability, strengthened food safety monitoring, and promoted supplier collaboration through controlled data-sharing systems. Based on Walmart's case, the study also identifies key limitations in Vietnam's retail supply chains and proposes practical recommendations to support blockchain adoption, improve traceability, and strengthen consumer trust.

Keywords: blockchain, supply chain transparency, traceability, retail, Walmart

1. Introduction

In today's highly globalized and interconnected business environment, supply chain management has become a critical determinant of competitiveness and operational efficiency. As supply networks expand across multiple countries and stakeholders, challenges such as information asymmetry, lack of data visibility, and limited traceability have increasingly undermined supply chain transparency. These challenges not only increase operational risks and inefficiencies but also erode consumer trust, especially in sectors like retail, where safety and origin verification are vital.

Blockchain technology has recently emerged as a transformative solution to these issues. Its core attributes, decentralization, immutability, transparency, and traceability, make it highly applicable to complex, multi-tiered supply chains. By enabling secure and tamper proof recording of transactions among supply chain participants, blockchain can enhance information sharing, reduce fraud, and strengthen accountability. Consequently, many global retailers have begun exploring blockchain based systems to improve supply chain visibility and build consumer confidence in product authenticity and quality.

Among these pioneers, Walmart stands out as one of the earliest and most prominent adopters of blockchain technology in supply chain management. Through collaborations with technology partners such as IBM, Walmart has implemented blockchain based traceability systems to track food products, beginning with pilot projects like pork in China and mangoes in the United States. These initiatives have demonstrated significant improvements in traceability speed, product safety, and supplier collaboration, positioning Walmart as a global benchmark for blockchain enabled supply chains.

Overall, this research aims to contribute to a deeper understanding of how blockchain technology can transform supply chain transparency and performance. By examining Walmart's pioneering adoption of blockchain and drawing lessons for Vietnam's retail industry, the report aims to bridge theoretical knowledge and practical application. The findings are expected to provide

valuable insights for both academics and practitioners seeking to enhance supply chain integrity and trust in an increasingly digitalized retail environment.

2. Theoretical framework

2.1. Definition of supply chain

A supply chain is a network of interconnected and interdependent organizations that work collaboratively to manage and improve the flow of materials and information from suppliers to end users (Christopher, 2016). It encompasses the full sequence of processes from raw material acquisition to final distribution, integrating suppliers, manufacturers, logistics providers, retailers, and consumers into a coordinated system (Christopher, 2016). At its core, supply chain management involves planning, executing, and controlling these flows of materials, information, and finances to enhance customer value while reducing overall system costs (Mentzer et al., 2001).

2.2. Supply chain transparency

2.2.1. Definition and importance of supply chain transparency

Supply chain transparency refers to the extent to which all stakeholders within a supply chain have access to accurate, timely, and relevant information regarding processes, materials, and products as they move from origin to final customer (Mol, 2015). It involves the clear disclosure of data across various stages of production, sourcing, and distribution, enabling stakeholders to understand how goods are produced, where they come from, and under what conditions (Egels-Zandén et al., 2015). Transparency thus reflects the degree of openness and visibility that organizations provide regarding their operations and relationships within the supply chain (Busse et al., 2017).

The importance of supply chain transparency has grown significantly in response to increasing consumer awareness, regulatory pressures, and ethical concerns (Doorey, 2011). Transparent supply chains enhance trust, accountability, and collaboration among partners, while helping organizations identify inefficiencies, reduce risks, and ensure compliance with environmental and social standards (Aung & Chang, 2014). Moreover, transparency supports corporate sustainability by allowing firms to verify responsible sourcing, minimize unethical practices, and respond effectively to stakeholder demands for greater disclosure (Mol, 2015; Jia et al., 2018).

Scholars typically conceptualize supply chain transparency through three key dimensions: visibility, traceability, and information sharing.

Visibility refers to the ability of firms to monitor and access real-time information about supply chain activities, such as inventory levels, production status, and logistics operations (Barratt & Oke, 2007).

Traceability involves the capability to track the history, location, and movement of products and materials through each stage of the supply chain (Garcia-Torres et al., 2019). It enables firms to identify the source of problems, verify authenticity, and ensure compliance with quality or ethical standards.

Information sharing represents the exchange of accurate and timely data among supply chain partners, fostering coordination and reducing uncertainty in decision-making processes (Li & Lin, 2006).

Together, these dimensions form the foundation of a transparent supply chain that promotes efficiency, responsiveness, and trust throughout the network.

2.2.2. Challenges in achieving supply chain transparency

Despite its recognized importance, achieving full transparency within supply chains remains a complex and challenging task. Various structural, technological, and relational barriers prevent firms from obtaining complete visibility and information sharing across the entire network (Busse et al., 2017; Mol, 2015). Among the most critical challenges are information asymmetry, lack of data visibility, and supplier fragmentation, each of which undermines trust and coordination among stakeholders.

Information asymmetry occurs when different actors in the supply chain possess unequal access to critical information about processes, materials, or performance (Hofstede, 2003). Upstream suppliers or intermediaries may withhold or distort information, intentionally or unintentionally, due to competitive pressures, fear of losing bargaining power, or lack of standardized reporting systems (Zhu et al., 2018). This imbalance reduces transparency, complicates risk assessment, and may result in unethical practices such as labor exploitation or environmental non-compliance remaining undetected (Egels-Zandén et al., 2015).

A second challenge lies in the lack of data visibility across complex global supply chains. Many organizations still rely on fragmented or legacy information systems that do not provide end-to-end data integration (Barratt & Oke, 2007). Inconsistent data formats, limited real-time tracking, and insufficient technological interoperability hinder firms from monitoring product flows, supplier performance, and compliance metrics (Aung & Chang, 2014). Consequently, companies struggle to respond swiftly to disruptions, quality issues, or sustainability concerns.

Supplier fragmentation further complicates transparency efforts. Modern supply chains often involve multiple tiers of suppliers dispersed across different regions, each with distinct capabilities, technologies, and governance structures (Wilhelm et al., 2016). Lead firms frequently have visibility only into their first-tier suppliers, while lower-tier partners remain opaque (Grimm et al., 2014). This multi-tier complexity increases the difficulty of obtaining accurate information and enforcing sustainability or ethical standards throughout the entire network.

Overcoming these challenges requires collaborative efforts among stakeholders, the adoption of advanced digital technologies such as blockchain and IoT, and the establishment of standardized reporting frameworks. Addressing these barriers is essential for building more resilient, ethical, and sustainable supply chains in the global economy.

2.3. Blockchain technology in supply chain management

2.3.1. Definition of blockchain technology

Blockchain technology is a decentralized and distributed digital ledger system that records and verifies transactions across multiple nodes in a network (Nakamoto, 2008). Each record, called a *block*, contains transaction data that are securely linked to previous blocks using cryptographic hashes, forming an immutable chain of information (Treiblmaier, 2018). This structure ensures that data once validated cannot be altered or deleted without network consensus, thus enhancing transparency and trust among participants (Saberi et al., 2019).

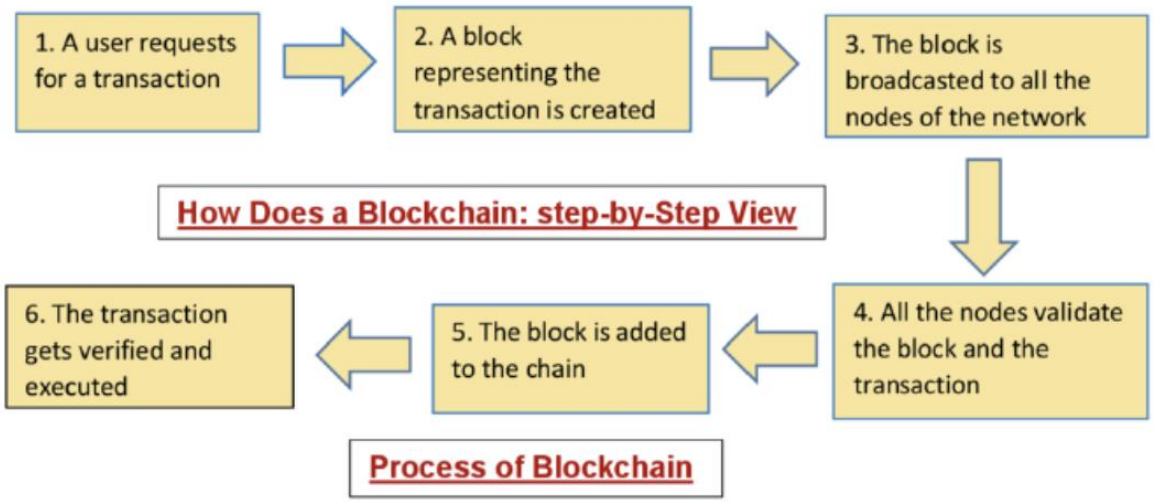

Figure 1. Process of blockchain technology

Source: 101 Blockchains, 2021

Unlike traditional centralized databases that rely on a single authority, blockchain operates through consensus mechanisms-such as Proof of Work (PoW) or Proof of Stake (PoS)-to validate transactions collectively (Casino et al., 2019). This decentralized validation process eliminates the need for intermediaries and increases the reliability of shared information.

In supply chain management, blockchain provides a secure and transparent platform for recording every transaction from production to distribution. It allows stakeholders-including suppliers, manufacturers, logistics providers, and retailers-to access a single, verified source of truth (Kshetri, 2018). As a result, blockchain enhances traceability, reduces fraud, and improves operational efficiency across complex global supply networks.

2.3.2. Key features of blockchain technology

Blockchain technology encompasses several essential features that collectively enhance its security, reliability, and efficiency in digital transactions. These characteristics - security, decentralization, and consensus - define how blockchain ensures trust and transparency across networks (IBM, 2024; Nakamoto, 2008).

a. Security

Blockchain provides robust security through cryptographic mechanisms that protect data integrity and prevent unauthorized access. Each transaction is encrypted and connected to the previous block using cryptographic hashes, making it nearly impossible to alter recorded information without detection (Treiblmaier, 2018). This design ensures tamper-resistance and safeguards data across distributed environments.

b. Decentralization

Unlike traditional centralized databases, blockchain operates on a decentralized architecture where no single entity holds complete control over the system. Instead, all participants maintain copies of the ledger and collectively validate transactions (Kshetri, 2018). This decentralization reduces dependency on intermediaries, enhances transparency, and mitigates the risk of systemic failures.

c. Consensus

Consensus mechanisms are fundamental to blockchain's operation, enabling distributed nodes to agree on the validity of transactions. Methods such as Proof of Work (PoW) and Proof of Stake (PoS) ensure that all participants reach a shared version of truth without the need for central verification

(Nakamoto, 2008; Casino et al., 2019). This process maintains consistency, trust, and fairness within the network.

These technological features not only distinguish blockchain from traditional centralized systems but also underpin its transformative potential in supply chain management - an area where transparency, traceability, and trust are essential.

2.3.3. Applications of blockchain in the retail industry

a. Enhanced supply chain transparency and traceability

The most prominent application of blockchain in retail is the enhancement of supply chain transparency and traceability. By recording every transaction and product movement on an immutable, distributed ledger, blockchain creates a single, verifiable source of truth for all stakeholders. This allows tracking of an item's full journey from origin to point of sale. A key advantage is combating counterfeits: each product can have a unique digital identity verified through a QR code, essential for luxury goods, pharmaceuticals, and organic foods. Blockchain also transforms food safety by enabling rapid source identification during contamination incidents, reducing trace-back time from days or weeks to seconds, supporting precise recalls and lowering public health risks (Bumblauskas, 2020). It further helps brands meet sustainability requirements by proving ethical origins of materials (Garaus et al., 2021).

b. Smarter inventory and logistics management

Blockchain technology facilitates smarter inventory and logistics management by providing a single, real-time, and shared view of product location and status, thereby significantly improving logistical efficiency. By integrating blockchain with Internet of Things (IoT) devices, retailers can achieve real-time monitoring of inventory levels and shipment conditions. This integration allows stakeholders to accurately monitor the precise location of shipments, reducing the risk of lost goods or delays. Furthermore, this synergy helps automate record-keeping, which minimizes manual errors and dramatically improves end-to-end supply chain visibility. This automation reduces administrative overhead, minimizes disputes, and accelerates the entire procure-to-pay cycle (IEEE, 2024).

c. Management of loyalty programs and customer data

Blockchain technology offers a novel approach to managing customer loyalty programs and securing personal data, addressing common frustrations for both retailers and consumers. It enhances transparency in these programs by creating a secure, fraud-resistant environment for storing customer data and reward points. This is often achieved by "tokenizing" loyalty points on a blockchain, which transforms them into interoperable digital assets. This decentralized system allows customers to easily trade, transfer, or redeem their rewards across a unified ecosystem of multiple partner retailers, rather than being "siloed" within a single company's program, thereby improving customer engagement and trust (Deloitte, 2019).

3. Application of blockchain in Walmart's supply chain

3.1. Overview of Walmart

3.1.1. Background of Walmart as a global retail leader

Walmart Inc. is the world's largest retailer by revenue, operating over 10,750 stores in 19 countries and employing approximately 2.1 million associates worldwide (Walmart, 2025). This enormous scale has created one of the most complex and extensive supply chains on the planet, managing millions of SKUs flowing continuously through thousands of suppliers, distribution centers, and retail outlets across multiple continents.

At the heart of Walmart's strategy since its founding in 1962 has been the "Everyday Low Price" (EDLP) model, a commitment to offering the lowest prices every day rather than relying on temporary promotions (Svensson, 2024). Sustaining EDLP requires rigorous cost control at every level and exceptional operational efficiency, making cost leadership and supply chain optimization Walmart's core competitive advantage.

3.1.2. Key features of Walmart's supply chain management

Walmart's supply chain is widely regarded as one of the most efficient and sophisticated in the world, built specifically to support its Everyday Low Price strategy through relentless cost reduction, speed, and scale.

- **Pioneering use of technology:** Early adoption of satellite networks, POS scanning, Retail Link, and RFID, followed today by AI, automation, and digital twins to enhance forecasting and operational efficiency.
- **Efficient cross-docking model:** Regional distribution centers are optimized for cross-docking, minimizing storage, reducing inventory holding costs, and accelerating product flow to stores.
- **Retail Link and deep supplier integration:** Real-time data sharing enables Vendor Managed Inventory (VMI) and Collaborative Planning, Forecasting, and Replenishment (CPFR) programs, reduces the bullwhip effect, improves forecast accuracy, and strengthens coordination with suppliers.
- **Massive scale in procurement and private logistics:** Walmart's massive purchasing volume and ownership of one of the largest private truck fleets lower transportation costs and support its EDLP strategy.

3.2. Implementation of blockchain in Walmart's supply chain

3.2.1. Walmart's blockchain application for food traceability

a. Pork traceability pilot in China

China is both one of the world's largest importers and producers of pork, accounting for nearly half of global output. Large-scale, industrialized production systems have gradually replaced small-scale "backyard" pig farming (Gale, 2017). As Chinese consumers have become increasingly concerned about food safety and product authenticity, trust has emerged as a critical factor in purchasing decisions. Responding to this shift, the Chinese government has invested heavily in strengthening food inspection, safety standards, and collaborations with multinational corporations to modernize its pork industry.

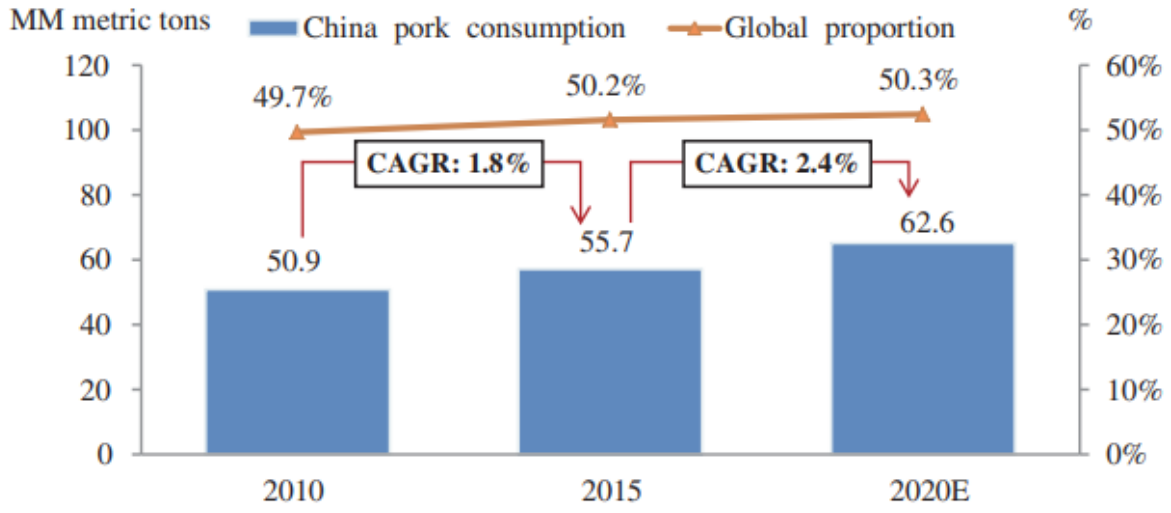

Figure 2. China pork consumption (2010 – 2022E)

Source: U.S. Department of Agriculture, 2015

With annual pork consumption reaching approximately 55.7 million tons, Walmart had strong incentives to explore technologies that could improve transparency and traceability in China's food system (USDA, 2015). In 2016, Walmart established the Food Safety Collaboration Center (Burkitt, 2014) and Doug McMillon, president and CEO of Walmart Stores pledged to invest $25 million over five years to advance global food safety research. In partnership with IBM, Walmart launched a blockchain-based pork traceability system utilizing Hyperledger Fabric.

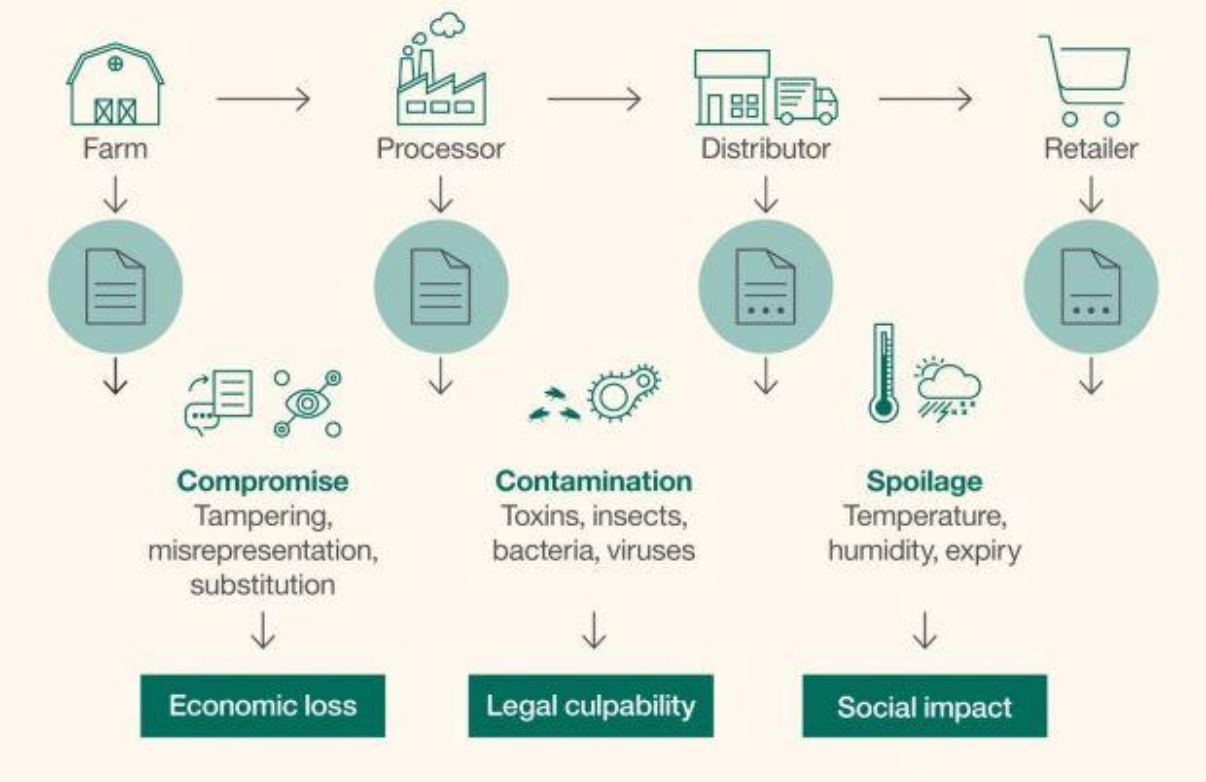

Figure 3. Blockchain technology allows traceability in the food chain

Source: fleischwirtschaft, 2016

Each pig was equipped with a unique barcode or radio frequency identification (RFID) tag, allowing continuous tracking from the farm stage to final packaging. Using radio-frequency identification and visual monitoring tools, participants recorded animal movements and production activities at every step, while cameras in slaughterhouses ensured full visibility of processing operations and compliance with animal welfare and temperature control standards (Clark, 2017). The system integrated Internet of Things (IoT) devices such as temperature and humidity sensors, GPS trackers for transport vehicles, and cameras in processing facilities to monitor conditions throughout the logistics chain. All information was uploaded to the blockchain in real time and stored as tamper-proof electronic certificates (e-certificates). Through this digital ledger, Walmart could instantly access verified data on farm origin, batch numbers, processing information, and shipping details. The traceability process, previously requiring several days of manual documentation, was reduced to mere seconds, significantly improving product recall responsiveness and minimizing economic losses (Kamath, 2018).

b. Mango traceability pilot in the Americas

Parallel to the pork traceability initiative in China, Walmart launched a blockchain pilot to trace mangoes imported from South and Central America to North America, in partnership with IBM using the Hyperledger Fabric platform. Mangoes were selected because they represent one of the most

complex and geographically dispersed produce supply chains, involving numerous stages from cultivation and harvest to packaging, export, distribution, and retail. Furthermore, mangoes are a product category particularly susceptible to Listeria and Salmonella contamination, making food safety assurance and traceability critical (Yiannas, 2017; Andrews, 2012).

In this pilot, every participant, including farmers, packing houses, logistics providers, importers and exporters, processors, distribution centers, and retail stores, entered relevant data onto the blockchain. Recorded information included farm location, soil and cultivation conditions, fertilizer and pesticide use, harvest data, storage and transport conditions, and quality inspection results at each checkpoint (National Mango Board, 2017). This comprehensive data capture provided an unbroken digital trail documenting each mango's journey from farm to shelf.

3.2.2. Integration process and technology framework

Walmart's integration of blockchain technology followed a systematic, multi-phase approach designed to enhance supply chain transparency and food safety. The process began with pilot projects built on early prototypes of Hyperledger Fabric that Walmart and IBM jointly developed. Hyperledger Fabric, a permissioned blockchain framework that enables secure data sharing among verified participants, later became the technological foundation for the IBM Food Trust platform, which was officially launched in 2018. (IBM, 2024). Two major proof-of-concept (PoC) trials were conducted - one for pork in China and another for mangoes in the United States. These pilots were selected due to recurring food safety issues and the complexity of traceability across cross-border supply chains (PixelPlex, 2024).

The pilot tests successfully demonstrated blockchain's capability to track the origin and movement of food products through every supply chain stage, from farm to retail shelf. Remarkably, the time required to trace the source of mangoes was reduced from seven days to 2.2 seconds, showcasing the efficiency of decentralized record-keeping (Kamath, 2018). Following these results, Walmart scaled the system by integrating its suppliers and logistics partners into a shared blockchain network - the IBM Food Trust ecosystem - alongside other industry players such as Nestlé and Unilever (PixelPlex, 2024).

Beyond its initial pilots in the U.S. and China, Walmart expanded blockchain adoption across multiple markets. In Walmart China, the company partnered with VeChain to build a traceability platform covering meat, seafood, and packaged vegetables. Meanwhile, Walmart U.S. continued to scale the IBM Food Trust network, onboarding hundreds of produce suppliers to ensure real-time visibility across the food chain. In Walmart Canada, the company introduced a blockchain-based freight and invoice management system, which automated data verification and reduced payment disputes between carriers and distributors. These region-specific implementations demonstrated Walmart's ability to adapt its blockchain framework to different supply chain environments while maintaining global standards of transparency and accountability (PixelPlex, 2024).

To enable interoperability, all participants adopted GS1 global data standards to ensure that product information could be uniformly recorded and interpreted across regions (Rejeb, Keogh, & Treiblmaier, 2020). Walmart also integrated complementary technologies such as IoT sensors and RFID tags to automatically capture data about temperature, humidity, and location throughout transport and storage (PixelPlex, 2024). These real-time inputs were directly uploaded to the blockchain ledger, ensuring continuous visibility and traceability.

From a technological standpoint, the blockchain system was synchronized with Walmart's existing ERP and inventory management platforms, enabling automated information flow. Chaincode (Smart Contracts) within Hyperledger Fabric were used to verify supplier compliance, record shipment conditions, and trigger alerts for any irregularities (Casino, Dasaklis, & Patsakis, 2019).

Overall, Walmart's integration process established a data-driven, transparent, and collaborative supply chain framework. By standardizing data input, leveraging IoT for traceability, and adapting

blockchain solutions to different markets, Walmart built a scalable digital ecosystem that redefined global standards for food safety and supply chain trust (PixelPlex, 2024; Walmart Inc., 2020).

3.2.3. Performance outcomes and industry impacts

The implementation of blockchain technology in Walmart's supply chain has generated significant performance improvements and influenced broader industry practices. Key outcomes include dramatic reductions in product tracing time, strengthened food safety and quality assurance, and enhanced collaboration with suppliers and regulatory stakeholders (IBM, 2018; Kamath, 2018).

Blockchain technology has also led to enhanced food safety and quality assurance. By recording every transaction and product movement on an immutable ledger, Walmart ensures data integrity and transparency across the supply chain. Each product's journey from farm to shelf is digitally documented, allowing real-time verification of product authenticity, storage conditions, and handling processes (Tian, 2017). This transparent traceability reduces the risk of fraud, mislabeling, and contamination, while aligning Walmart's operations with global food safety standards set by agencies such as the U.S. Food and Drug Administration (FDA).

Furthermore, Walmart's blockchain initiative has fostered stronger supplier collaboration and accountability. By requiring suppliers to input data directly into the blockchain, Walmart created a shared digital ecosystem where all stakeholders can access verified and synchronized information (Kshetri, 2018). This encourages suppliers to adhere to consistent data reporting practices, improving coordination and trust throughout the network. Smaller suppliers, who previously lacked technological infrastructure for traceability, benefit from a standardized digital framework that levels the playing field and integrates them more effectively into global supply chains.

3.3. General evaluation: Key success of Walmart's blockchain adoption

Walmart's blockchain adoption demonstrates how distributed ledger technology can transform the structure and governance of global supply chains. In the pork traceability project in China, blockchain enabled the company to move beyond traditional, paper-based systems toward a decentralized, tamper-proof data network that connected every actor from pig farms and slaughterhouses to distributors and retail outlets under a unified, transparent framework. This integration addressed one of Walmart's most critical challenges: ensuring end-to-end transparency and accountability in food safety management within a complex, multi-tiered supply chain.

The key success of Walmart's initiative lies in its ability to operationalize multiple dimensions of supply chain transparency. First, traceability was drastically improved as blockchain allowed real-time tracking of every product batch, with data accessible instantly through immutable digital records. Second, visibility and information integrity were enhanced through the integration of IoT devices, such as temperature and humidity sensors, GPS tracking, and smart tagging that continuously verified storage and transport conditions. Third, accountability was strengthened by recording every transaction and inspection as a time-stamped entry on the blockchain, reducing the potential for falsification or blame-shifting among suppliers.

From a broader perspective, Walmart's case also illustrates how blockchain fosters collaboration and trust across the supply chain ecosystem. Blockchain reduces inter-organizational power asymmetry by creating a shared information environment where suppliers, regulators, and retailers possess equal visibility into product data. This redistribution of informational power mitigates opportunistic behaviors and promotes joint responsibility for food safety outcomes.

4. Lessons for Vietnam's retail supply chain

4.1. Overview of Vietnam's retail supply chain

4.1.1. The current landscape of the Vietnamese retail supply chain

The Vietnamese retail supply chain is currently defined by a high-stakes paradox: explosive, double-digit market growth running parallel to persistent, deep-seated infrastructural and operational inefficiencies. The total retail market value was estimated at approximately $298.2 billion in 2024 and is projected to maintain strong growth, presenting a lucrative landscape for both domestic and international players (IMARC Group, 2024). However, this rapid expansion masks the fragility of the underlying supply network.

This landscape is characterized by a dramatic and accelerating structural shift, moving from traditional, fragmented channels to modern, centralized models. While traditional trade which comprises tens of thousands of independent grocery stores and wet markets still holds a significant 62% market share, this represents a sharp decline from 73% in 2020. This traditional channel, for the first time, has seen an absolute decline in sales, signifying a fundamental turning point in consumer behavior. This lost share has been directly captured by organized modern trade, which grew to 27%, and by a booming e-commerce sector, which now accounts for 11% of all retail sales (Cimigo, 2025). E-commerce, in particular, has become a critical driver, with Vietnam's market size surpassing $25 billion in 2024, reflecting a remarkable 20% year-on-year growth (VIR, 2025).

At the same time, Vietnam's retail sector is undergoing rapid digitalization, compelled by retailers' increasing adoption of electronic payments, online-to-offline (O2O) models, real-time inventory systems, and integrated logistics technologies. These transitions are essential responses to rising consumer expectations for faster delivery, transparent product information, personalization, and seamless omnichannel experiences. Together, these structural, technological, and behavioral shifts are reshaping competition and placing strong pressure on Vietnamese supply chains to modernize and adapt.

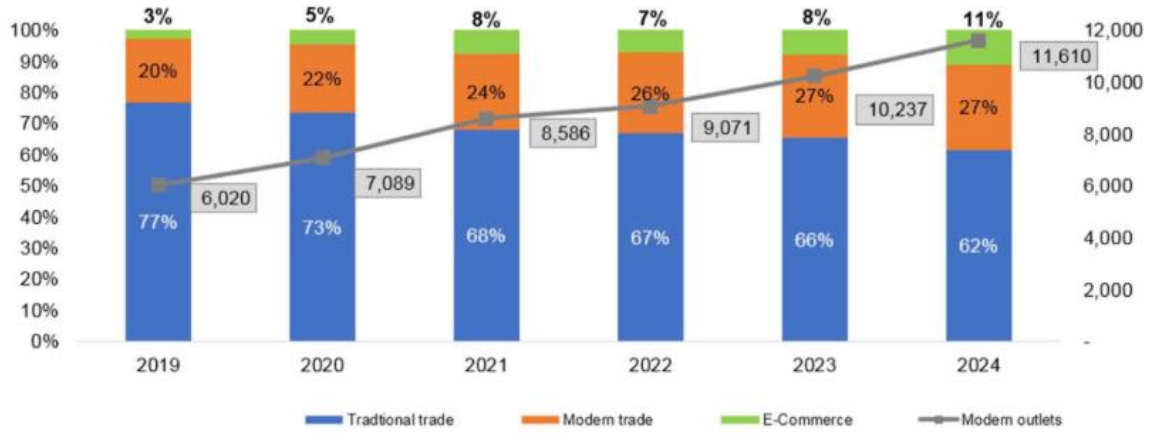

Figure 4. Retail sales contribution (%) and number of modern self-service outlets

Source: Cimigo, 2024

4.1.2. Key supply chain challenges in the Vietnamese retail industry

a. Data fragmentation and lack of end-to-end traceability

The foundational challenge underpinning Vietnam's retail supply chain lies in profound data fragmentation, which severely inhibits end-to-end traceability. Information remains largely trapped in isolated "silos": from the smallholder farmer through logistics providers, processors and final retailers, each stakeholder often operates on separate systems with little or no interoperability (Vietstock, 2025).

Particularly upstream, at farm or small-producer level, record-keeping for critical data such as planting, harvesting and transportation often remains manual and paper-based. This dependence on analog processes is a major barrier to digital enablement; even among SMEs with some technology adoption, their systems are frequently legacy platforms that lack external connectivity (Hanoi Times, 2025). As a result, the information "chain" is broken at every hand-off, making it difficult to synchronize data flows between suppliers, transporters, and retailers.

b. High prevalence of counterfeit goods and food safety risks

Counterfeiting remains a pervasive threat within Vietnam's retail supply chain, spanning from food and pharmaceuticals to cosmetics and luxury items. In the first half of 2025 alone, authorities handled over 50,000 violations related to smuggling, trade fraud, and counterfeit goods, including critical sectors such as dairy, seasoning, and functional foods. These fake products often infiltrate formal retail channels, sometimes disguised in highly sophisticated packaging, which poses significant health risks to consumers (Vietnam.vn, 2025). Technology is being explored as a key defense: national efforts are underway to deploy a traceability system (NDA Trace) based on blockchain and QR-code technology, aiming to provide a tamper-proof digital "passport" for products and curb counter-falsification (TuoiTre News, 2025).

c. Erosion of consumer trust due to data opacity

Consequently, the combination of data fragmentation, counterfeit risks, and safety vulnerabilities would result in a significant erosion of consumer trust. Although modern traceability platforms, such as blockchain-based systems, are being gradually deployed, data remains scattered across agencies and not fully integrated, preventing consumers from verifying product history in a reliable way (Vietnam.vn, 2025). In today's retail environment, consumers are no longer passive recipients; they actively demand transparency regarding product provenance, safety, and ethical sourcing. When supply chains are opaque, each food safety incident or counterfeit product discovery reinforces public skepticism. This lack of trust is not merely a reputational concern but has tangible economic consequences, as consumers increasingly favor foreign brands perceived to offer stronger traceability.

4.2. Lessons from Walmart for the Vietnamese retail industry

Walmart's experience with blockchain adoption offers several valuable lessons for the Vietnamese retail industry seeking to enhance transparency, efficiency, and accountability in their supply chains. One of the key takeaways is the importance of digitalization as a foundation for transparency. Walmart's success in tracing food origins within seconds was built on its strong digital infrastructure, where data was standardized, integrated, and accessible across multiple suppliers and distribution points. For Vietnamese retailers, this implies that before implementing blockchain, companies must first modernize their existing supply chain systems through digital record keeping, enterprise resource planning (ERP) platforms, and Internet of Things (IoT) tracking technologies.

Another crucial lesson lies in the approach to implementation. Walmart began its blockchain journey with small scale pilot projects such as tracing mangoes in the United States and pork products in China, before expanding the system to a wider range of suppliers. This gradual, data driven approach allowed the company to test the technology's feasibility, identify operational challenges, and refine its processes in a controlled environment. For Vietnamese retailers, adopting a similar strategy, starting small, evaluating performance, and then scaling up can help manage risks, control costs, and foster long term success.

Moreover, fostering collaboration and ensuring ecosystem readiness are vital to successful blockchain implementation. Blockchain, by nature, depends on a network of participants who collectively maintain and verify the integrity of shared data. For Vietnamese retailers, this means that blockchain adoption should be viewed as an ecosystem effort rather than an isolated corporate project. Firms should actively engage with technology providers, government agencies, industry associations,

and even academic institutions to establish shared data standards, compatible digital infrastructure, and supportive legal frameworks.

Finally, Walmart's case demonstrates that blockchain can be more than a management or traceability tool. By making supply chain information transparent, Walmart positioned itself as a global leader in food safety, ethical sourcing, and corporate responsibility. In the Vietnamese retail market, where concerns over product authenticity, food safety, and supply chain integrity remain widespread, the potential impact of blockchain is even greater. Retailers that leverage blockchain not only to manage operations but also to communicate transparency to consumers can differentiate themselves from competitors and foster stronger brand loyalty.

These lessons from Walmart underline that blockchain adoption is not merely a technological decision but a strategic transformation requiring digital readiness, collaboration, phased implementation, and consumer centric thinking. For the Vietnamese retail industry, embracing these insights could mark a pivotal step toward modernizing supply chains and aligning with global standards of transparency and sustainability.

5. Conclusion

As global supply chains become increasingly complex, the retail industry faces mounting challenges in ensuring transparency, traceability, and accountability across every stage of production and distribution. Information asymmetry, fragmented data systems, and the lack of trust among supply chain participants have long hindered efficiency and responsiveness. In this context, blockchain technology has emerged as a transformative solution, offering a secure, decentralized framework for recording, verifying, and sharing data in real time.

Walmart's experience as one of the early adopters of blockchain demonstrates how the technology can be effectively integrated into retail supply chains through a clear strategy and strong partnerships. By adopting a phased implementation plan and collaborating closely with IBM, suppliers, and regulators, Walmart enhanced data accuracy and interoperability across its network which help reduce product trace times from days to seconds and set a new benchmark for transparency. For Vietnam's retail industry, this case highlights the importance of first establishing robust digital infrastructure and standardized data systems as the foundation for blockchain adoption. Starting with small-scale projects can help businesses minimize risks while gradually building internal expertise, whereas close cooperation among retailers, technology providers, and policymakers is vital to creating an ecosystem where blockchain can deliver lasting value.

Overall, this report underscores that blockchain adoption is as much a strategic and organizational transformation as it is a technological one. For Vietnam's retail industry, embracing these insights could mark a significant step toward building modern, reliable, and consumer-oriented supply chains. With strong digital foundations, collaborative ecosystems, and a commitment to transparency, Vietnamese retailers can harness blockchain not only to improve operational efficiency but also to redefine competitiveness and trust in the domestic market.

Reference

2019 ESG. (n.d.). *2019 Walmart Environmental, Social & Governance Report*. [online] Available at: https://corporate.walmart.com/esgreport.

Andrews, J. (2012). *Food Safety News*. [online] Food Safety News. Available at: https://www.foodsafetynews.com/2012/10/mango-outbreaks-connected-through-interviews/ [Accessed 18 Nov. 2025].

Aung, M.M. and Chang, Y.S. (2014). Traceability in a Food Supply chain: Safety and Quality Perspectives. *Food Control*, 39(2), pp.172–184. doi:https://doi.org/10.1016/j.foodcont.2013.11.007.

baochinhphu.vn (2024). *Giảm chi phí logistics để nâng cao năng lực cạnh tranh cho hàng hóa Việt Nam*. [online] https://baochinhphu.vn/giam-chi-phi-logistics-de-nang-cao-nang-luc-canh-tranh-cho-hang-hoa-viet-nam-102240306085403838.htm [Accessed 18 Nov. 2025].

Barratt, M. and Oke, A. (2007). Antecedents of Supply Chain Visibility in Retail Supply Chains: A Resource-Based Theory Perspective. *Journal of Operations Management*, 25(6), pp.1217–1233. doi:https://doi.org/10.1016/j.jom.2007.01.003.

Bumblauskas, D., Mann, A., Dugan, B. and Rittmer, J. (2020). A blockchain use case in food distribution: Do you know where your food has been? *International Journal of Information Management*, 52(102008), p.102008. doi:https://doi.org/10.1016/j.ijinfomgt.2019.09.004.

Casino, F., Dasaklis, T.K. and Patsakis, C. (2019). A Systematic Literature Review of blockchain-based applications: Current status, Classification and Open Issues. *Telematics and Informatics*, 36(36), pp.55–81. doi:https://doi.org/10.1016/j.tele.2018.11.006.

Christopher, M. (2016). *Logistics & supply chain management. 5th ed. Harlow: Pearson Education.*

Cimigo (2025). *Xu hướng tiêu dùng Việt Nam 2025 - Market research Vietnam Indonesia*. [online] Market research Vietnam Indonesia. Available at: https://www.cimigo.com/vi/trends/xu-huong-tieu-dung-viet-nam-2025/.

Duy, M. (2025). *Vietnam to launch national traceability system to fight counterfeit goods*. [online] Tuoi tre news. Available at: https://news.tuoitre.vn/vietnam-to-launch-national-traceability-system-to-fight-counterfeit-goods-103250723170012015.htm [Accessed 18 Nov. 2025].

Egels-Zandén, N., Hulthén, K. and Wulff, G. (2015). Trade-offs in supply chain transparency: the case of Nudie Jeans Co. *Journal of Cleaner Production*, 107(107), pp.95–104. doi:https://doi.org/10.1016/j.jclepro.2014.04.074.

Gale, F. (2017). *China's Pork Imports Rise Along with Production Costs | Economic Research Service*. [online] Usda.gov. Available at: https://www.ers.usda.gov/publications/pub-details?pubid=81943 [Accessed 18 Nov. 2025].

Garcia-Torres, S., Albareda, L., Rey-Garcia, M. and Seuring, S. (2019). Traceability for sustainability – literature review and conceptual framework. *Supply Chain Management: An International Journal*, 24(1), pp.85–106. doi:https://doi.org/10.1108/scm-04-2018-0152.

Giang, B.T. (2025). *Ứng dụng công nghệ để ngăn chặn hàng giả*. [online] vietnam.vn. Available at: https://www.vietnam.vn/ung-dung-cong-nghe-so-trong-chong-hang-gia [Accessed 18 Nov. 2025].

Hamdan, S. (2025). *Bachelor's Programme in International Business Blockchain Implementation in the Retail Industry: Success, Suitability, and Supply Chain Transformation Assessing the Suitability of Blockchain Technology in Retail Supply Chains*. [online] Available at: https://aaltodoc.aalto.fi/server/api/core/bitstreams/37533104-d03e-4ef6-808c-e8b9df1739d8/content.

Hanoitimes (2025). *Amid competitive challenges, Vietnam's logistics sector embraces digital transformation*. [online] Hanoitimes.vn. Available at: https://hanoitimes.vn/amid-competitive-challenges-vietnams-logistics-sector-embraces-digital-transformation-329046.html.

IBM (2019). *IBM Food Trust*. [online] Ibm.com. Available at: https://www.ibm.com/blockchain/solutions/food-trust.

Imarcgroup.com. (2025). *Vietnam Retail Market Size, Share, Growth, Forecast 2033*. [online] Available at: https://www.imarcgroup.com/vietnam-retail-market [Accessed 18 Nov. 2025].

Kamath, R. (2018). Food Traceability on Blockchain: Walmart's Pork and Mango Pilots with IBM. *The Journal of the British Blockchain Association*, [online] 1(1), pp.1–12. doi:https://doi.org/10.31585/jbba-1-1-(10)2018.

Mango.org. (2025). *Mango Production & Postharvest Best Practices*. [online] Available at: https://www.mango.org/industry/improving-mango-quality/mango-production-postharvest-best-practices/.

Mentzer, J.T., DeWitt, W., Keebler, J.S., Min, S., Nix, N.W., Smith, C.D. and Zacharia, Z.G. (2001). Defining Supply Chain Management. *Journal of Business Logistics*, 22(2), pp.1–25. doi:https://doi.org/10.1002/j.2158-1592.2001.tb00001.x.

Phillip, S. (2024). *Quartr*. [online] Quartr.com. Available at: https://quartr.com/insights/company-research/walmart-walton-retailing-and-everyday-low-prices.

Rejeb, A., Keogh, J.G., Zailani, S., Treiblmaier, H. and Rejeb, K. (2020). Blockchain Technology in the Food Industry: a Review of Potentials, Challenges and Future Research Directions. *Logistics*, [online] 4(4), p.27. Available at: https://www.mdpi.com/2305-6290/4/4/27.

Saberi, S., Kouhizadeh, M., Sarkis, J. and Shen, L. (2019). Blockchain technology and its relationships to sustainable supply chain management. *International Journal of Production Research*, 57(7), pp.2117–2135. doi:https://doi.org/10.1080/00207543.2018.1533261.

Van, T. (2025). *Vietnam's e-commerce market surpasses $25 billion in 2024*. [online] Vietnam Investment Review - VIR. Available at: https://vir.com.vn/vietnams-e-commerce-market-surpasses-25-billion-in-2024-120262.html

Walmart (2025). *About Walmart*. [online] Walmart. Available at: https://corporate.walmart.com/about.

Yiannas, F. (2018). A New Era of Food Transparency Powered by Blockchain. *Innovations: Technology, Governance, Globalization*, [online] 12(1-2), pp.46–56. doi:https://doi.org/10.1162/inov_a_00266.