





Strategic Framework for Blockchain-Enabled Supply Chains in the Web 3.0 Era

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Received: October 10th, 2025 | **Accepted:** April 10th, 2026

ABSTRACT

In the Web 3.0 era, blockchain emerges as a disruptive technology offering robust solutions for industries aiming to optimize and sustain their supply chains. With features such as decentralization, transparency, traceability, and immutability, blockchain ensures data security, prevents corruption or unauthorized access, and enables seamless interoperability. This study identifies and analyzes 10 key strategies for blockchain adoption in supply chains through a rigorous PRISMA-based literature review. Using the m-TISM methodology, a strategic framework is developed to define interrelationships among strategies, followed by a MICMAC analysis to classify them based on driving power and dependence. Findings highlight three pivotal strategies: identifying complex processes suited for blockchain, spreading awareness among supply chain partners, and fostering training and capacity building. These strategies drive effective adoption across industries. Further, a path analysis suggests three implementation pathways, offering industries a structured roadmap for smooth blockchain integration.

KEYWORDS

Blockchain, Supply Chain, Disruptive Technology, Strategies, Web3.0

1. INTRODUCTION

Supply Chain Management (SCM) lies at the heart of business models across finance, healthcare, retail, agriculture, logistics, transportation, construction, mining, and many other sectors (Zhang, Lv et al., 2024). SCM encompasses processes such as sourcing raw materials, manufacturing finished

DOI: 10.4018/JDM.408104

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goods, transporting goods, and providing customer service. All these processes require efficient planning, coordination, and systems to model and trace products for the timely, safe, and satisfactory disposal of customers' goods and services.

Presently, due to increasing awareness among young, digitally savvy customers, the market calls for greater translucency and traceability of manufactured goods; product disclosure has consequently increased. The disclosure, which defines the What (What do the industries produce?), How (How do the industries produce?) and Where (From where the industries source their raw materials or products?) of the manufactured products prove to be the need of the hour (Vinayavekhin et al., 2024).

The increasing incidence of counterfeiting, driven by insufficient information disclosure, has eroded customer trust. The global trade in counterfeit products is estimated at \$4.5 trillion, and online vendors are the largest contributors, accounting for approximately 40% of sales of counterfeit luxury items (Chen, 2024). Businesses often suffer significantly from counterfeiting, as customers' distrust of the authenticity of luxury items reduces overall sales, revenue, and market share. From a customer's perspective, counterfeit luxury goods are detrimental because they erode trust among potential buyers. Louis Vuitton Moët Hennessy (LVMH), a French luxury goods company, spends \$17 million annually on anti-counterfeiting legal actions (Chen et al., 2024; Vosooghidizaji et al., 2020). While counterfeiting goods induces a lack of trust amongst the customers, the opacity and isolation of information or Information Silos bring about distrust among the collaborating parties of an industry. In some cases, due to personal interests, participants may withhold relevant information, creating an information imbalance among the parties. This is known as Information Asymmetry. This may allow upstream suppliers to deceptively manufacture duplicates of branded products, resulting in counterfeit (X. Zhu et al., 2024). Due to insufficient information, the parties may also make poor decisions, particularly in financial matters, thereby increasing the firm's exposure to financial risks and attacks.

The global food crisis is a major threat to the agri-food supply chains. Reports from the United Nations (UN) Global Food Programme and World Bank Group, in November 2024, suggest that a total of 1.9 million people are suffering from food and nutrition crises, mainly due to conflicts between countries and climate change (UN - WFP, 2024). This calls for solutions that provide sustainability to control environmental distress and conflicts (Hasteer et al., 2023). Another major factor contributing to this global issue is land degradation, and the population exposed to it (World Bank Group, 2024). Due to globalization, countries import and export a variety of food products. Now, if the importing country is unaware of the environmental conditions (including the soil quality and manufacturing conditions) of the exporting country, the nutritional level of the food products imported will be dubious, putting the well-being and health of the citizens in danger (Hasteer et al., 2024; Tyagi et al., 2024).

Furthermore, high levels of production and consumption are causing environmental imbalance and indirectly contributing to problems such as soil erosion, pollution, and biodiversity loss due to excessive pressure on natural resources. Thus, it is high time we promote circular supply chain management (CSCM) over traditional supply chains, as CSCM encourages industries to reuse one another's waste as raw materials, thereby enabling effective waste management. T. Zhang et al., 2024 suggest that Industry 4.0 technologies, such as the Internet of Things (IoT), Artificial Intelligence (AI), and blockchain, can be practical for ensuring environmental sustainability by promoting the digitalization of data and records and safeguarding their integrity.

Various global happenings, such as the COVID-19 pandemic or the Russia-Ukraine war, turned the world upside down. The lack of preparedness and resources during the COVID-19 pandemic resulted in havoc, where many people lost their lives. In India, the first peak (October 2020) and the second peak (April 2021) of COVID-19 led to shortages of medical equipment, oxygen, staff, and even hospital beds for critical patients. A shortage of food and medical supplies (oximeters, nebulizers, sanitizers, and antipyretic drugs) arose as people began rationing them extensively, leaving nothing for critically ill patients. Even medical waste generated during this period that could not be recycled

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