Chapter 6
Blockchain and Machine Learning Framework for Financial Performance in Pharmaceutical Supply Chains

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ABSTRACT

Financial performance assesses how well a company can manage resources from its primary line of business and create income. Financial performance is critical for the healthcare sector, especially pharmaceutical supply chains. Medicine shortage is the main problem in healthcare management. Medicine shortages negatively affect patient care and financial performance. This chapter explains how blockchain technology and machine learning framework can contribute to pharmaceutical supply chains regarding financial performance. The proposed framework contributes to business analytics tools by presenting a hybrid machine learning method to improve financial performance.

1. INTRODUCTION

Despite being a driving force for economic growth and progress worldwide, the pharmaceutical industry faces severe challenges regarding drug scarcity and manufacturing glitches (Spieske et al., 2022). The scarcity of necessary medicines has become a critical issue globally that could endanger human lives. Production delays due to legal battles, natural disasters, trade wars, and unbalanced supply demand are

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why drugs may not reach their intended recipients on time. Patients who rely heavily on prescribed drugs for their health and well-being face severe risks because of this deficit in medication supply. Hospitals across the globe have faced shortages of indispensable medications utilized to treat cancer, alleviate pain, and offer anesthesia during surgeries (Nguyen et al., 2022). As a result of this dearth, many individuals requiring medical attention have been forced into long waiting lists with prolonged suffering from their ailments (Rajpurkar et al., 2022).

Blockchain technology can provide a secure and transparent data platform that can be utilized to collect and store data in pharmaceutical supply chains, which can be employed to train machine learning algorithms for optimization and automation purposes (Sadeghi R. et al., 2022). One of the significant advantages of blockchain technology is its ability to provide a tamper-proof and auditable data trail, ensuring the integrity and authenticity of the data (Griggs et al., 2018). In pharmaceutical supply chains, this can be particularly useful in tracking the movement of drugs from the manufacturer to the end customer, ensuring that the drugs are not counterfeit or subject to diversion. The data captured on the blockchain can be analyzed using machine learning algorithms to gain insights and identify patterns that can be used to optimize supply chain operations (Hajian et al., 2023). For example, algorithms can be trained to predict demand, identify inefficiencies in the supply chain, and optimize inventory levels at various points in the supply chain (Nguyen et al., 2022). The algorithms can also detect and prevent counterfeiting or diversion of drugs, thus ensuring patient safety and compliance with regulations. Furthermore, blockchain technology can also automate certain aspects of the pharmaceutical supply chain, such as drug tracking and payment processing (Bashir, 2018). This can help reduce manual labor, improve operational efficiency, and reduce costs. Blockchain technology provides a secure and transparent data platform that can be employed to collect and store data in pharmaceutical supply chains. This data can then be utilized to train machine learning algorithms to optimize supply chain operations and inventory, which results in better financial performance (Casino et al., 2019).

2. INVENTORY AND FINANCIAL PERFORMANCE

Inventory management is a crucial factor in determining the financial performance of a business (Cannon, 2008). Effective inventory management can reduce inventory holding costs, increase cash flow, and improve profitability (Santhi & Karthikeyan, 2016). Optimizing inventory levels is one way to improve financial performance (Cannon, 2008). Maintaining the right amount of inventory helps ensure a business has enough stock to meet customer demand without overstocking, which ties up capital and increases carrying costs. A business can optimize inventory levels and reduce inventory holding costs using inventory management techniques such as demand forecasting, safety stock calculations, and economic order quantity models (Sadeghi & Niaki, 2015).

Another way inventory management can improve financial performance is by reducing stockouts. A stockout occurs when a business runs out of a particular product, leading to lost sales and dissatisfied customers. By using inventory management tools based on machine learning algorithms such as just-in-time (JIT) inventory management and vendor-managed inventory (VMI), a business can ensure that it always has the necessary inventory to meet demand and avoid stockouts (Sadeghi & Niaki, 2015).