Chapter 62
Distributed Trust Using Blockchain for Efficient Pharmaceutical Supply Chain

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ABSTRACT

With traditional ERP systems, there is a lack of networking among suppliers, partners, and logistics providers. So, there is a need to have a holistic view of production and movement of goods from production to last mile delivery. The physical and digital supply chains need to be integrated to ensure secure supply chains that promote business excellence, collaboration among stakeholders, and reduce costs. The high-level view over their supply chains allows them to function better in a multi-channel world. It also helps them identify where to reduce stock without compromising customer service. Otherwise, it leads to a delay in delivery, counterfeit products, thefts, fraud, and cyberpiracy, which may lead to lawsuits and losing of brand image. The tacit function of supply chain management is to provide tracking of specific goods in the supply chain. So, it is imperative to leverage the blockchain technology stack to map multi-enterprise value networks and enable connected multi-modal networks.

INTRODUCTION

This chapter provides an overview of vulnerabilities in the security of the pharma supply chain, transportation constraints related to pharma products and compliance challenges. It also explains the blockchain technology and its application to pharma supply chain to overcome the challenges. The objective of this chapter is to provide an overview of blockchain as a technology to streamline a heterogeneous systems into a homogenous systems so as to ensure secure digital pharma supply chain. It also provides a high-level architecture in order to institutionalize blockchain as a backbone for the secure digital supply

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chain. There are multiple scenarios in pharma manufacturing and supply chain management where the blockchain can help clear bottlenecks, ensure greater GMP/GDP compliance, and reduce operational expenses. The blockchain is being applied in supply chains, insurance, payments, audits and customs brokerage. This chapter also provides a brief introduction about AR and RFID technology and vulnerabilities in the security of RFID technology and how to overcome it.

BACKGROUND

The blockchain is a digital database using blocks that are linked and secured by cryptography and can be used to keep a record of any information or assets. This includes physical assets, like transportation containers, or virtual assets, like digital currencies. It is a digital ledger system (DLT) used to record and log transactions, grouping them into 'blocks'. In each step of the distribution process in the pharma supply chain, a network of computers will vouch for the provenance and authenticity of a drug shipment. Each participant controls a node on the network, and transactions require a consensus. The permission-based nature of the node system is a superior way for companies to share information with partners and customers without "leaking key business information". So private blockchain is preferred over public blockchain. One use is to register the transfer of goods between two parties, identified as two addresses in the blockchain. The transaction logged in the blockchain would include relevant supply chain information such as location, date, price, temperature, humidity and quantity, which would be available in the distributed ledgers. This makes it possible for anyone involved in this transaction to trace every ingredient or component to its place of origin. The decentralized ledger makes it impossible for anyone to manipulate this data, giving regulators such as food standards agencies or drugs regulators the ability to determine who is responsible for contamination or other breaches of compliance. Blockchain could provide significant benefits, with barcode-tagged drugs scanned and entered into secure digital blocks whenever they change hands. This ongoing real-time record could be viewed anytime by authorized parties and even customers at the far end of the supply chain.

Blockchain promises to be the ultimate trust machine. It can transform the role of the traditional intermediaries. It consists of two parts of the business ecosystem namely application and infrastructure. It creates institutional trust, reduction of grey markets and patient safety for the society. It increases interoperability, waste reduction, and better visibility of the supply chain for the industry. It increases ROI and optimizes resource allocation for the organization. (Srivastava & Mahlum, 2017).

Suppose a user requests a transaction, it is broadcast to a network consisting of computers known as nodes. This network of nodes validates the transaction and the user's status using known algorithms. A verified transaction may involve cryptocurrency, contracts, records or other information. Once verified the transaction is combined with other transactions to create a new block of data for the ledger. The new block is added to the existing blockchain, in a way that is permanent and unalterable. Distributed ledgers may be private or public and can vary in structure and size. In public blockchain, each user has a copy of the ledger and participate in confirming transactions. Where as in private blockchain, permission is required for users to have a copy of the ledger and to participate in confirming transactions (Sabogal, 2017)

Supply chain security is one aspect that has recently won attention when the DSCSA has been implemented in the U.S under Obamacare to, amongst others, fight the counterfeit drug problem and to ensure the traceability of the medicinal product along the supply chain. After successful implementation, the act enables verification of the legitimacy of a drug, enhance detection of illegal drugs and facilitate recalls