

# Chapter 55

## Blockchains for Value Creation and Supply Chain Optimization

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### ABSTRACT

*Managing today's highly dispersed and intertwined supply chain in order to maximize the overall organizational benefit by leveraging partner competencies is a herculean task and one that is of ever-growing importance in a highly competitive and truly globalized market. Information technology in the form of point-of-sale data, materials requirement planning software, and enterprise-wide systems have often been leveraged to assist with this. However, with the proliferation of data, storing, managing, and analyzing data on a large scale is a challenge. Blockchains provide numerous benefits such as data transparency, immutability, and traceability that are so critical in building a cohesive cyberinfrastructure that facilitates cooperation and collaboration among supply chain partners. This chapter examines the characteristics of blockchain that make it suitable for supply chains and explore how the benefits afforded by blockchain can be leveraged to enhance value creation while optimizing the supply chain.*

### INTRODUCTION

In today's globalized world, companies world over are increasingly focusing on their own core competencies while relying on specialized third-party vendors for other tasks that help bring the product or service to the market. For example, Apple focuses on the design of its products while outsourcing manufacturing and assembly. This trend combined with the affordances of modern technology has resulted in companies collaborating with a diverse group of partners from around the world. This has engendered a supply chain behemoth that is complex, highly intertwined and geographically very distributed. As a result, supply chain management has been growing in importance in today's manufacturing and production arena.

Another effect of globalization is the opening of markets thereby providing companies access to customers around the world. This has led to stiff competition often driving down prices much to the relish of customers. However, in order to stay competitive on cost, product features and responsiveness,

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companies need to be able to leverage the strengths of all its partners to maximize output with minimum resources. Hence supply chain optimization for enhanced value creation has become indispensable.

Blockchain is defined as a distributed public ledger that maintains a record of all transactions in an encrypted form and is distributed across a peer network. The system does not allow any part of the information to be deleted either intentionally or unintentionally thus ensuring data security. Blockchain represents a paradigm shift in building a secure cyber infrastructure. Traditionally, cybersecurity has been accomplished by housing servers behind firewalls and multiple levels of encryption. However, the problem with such a system is that it makes the system a vulnerable target to intrusions due to a single point of failure. In blockchains, digital information is stored on multiple geographically dispersed peer locations and in an encrypted form that requires significant computing power to break.

The invention of blockchain and its growing prominence is said to be the next biggest thing after the Internet that has the power to effect sweeping transformations in almost all industries ranging from agriculture to utilities (Mougayar, 2016). It has been suggested that blockchains will store more than 10 percent of the global GDP by the year 2027 (Carson, Romanelli, Walsh and Zhumaev, 2018). Moreover, venture capitalists are also showing significant interest in start-ups that deal with this technology by providing financial backing to these companies. Bitcoin is one popular application of this technology. Here, the underlying blockchain technology is used for harnessing and accumulating cryptocurrency.

Blockchain affords the benefits of providing a secure cyberinfrastructure that connects all partners on the supply chain that facilitates increased cooperation and collaboration resulting in increased value creation. This chapter delves into blockchain and its applications in various industries while examining the requirements and challenges involved in employing this technology.

## **BACKGROUND**

Blockchain is a technology that Satoshi Nakamoto (which is probably a pseudonym for a person or a group of people) invented to facilitate sharing of digital information while ensuring data security. The original premise of the technology (Nakamoto, 2008) dealt with cryptocurrency. However, since then, blockchain has found application in numerous realms for a wide variety of purposes. Before diving into the applications, it helps to examine the foundations of a typical blockchain.

### **Basics of Blockchain**

Blockchain has been defined as a distributed ledger that maintains a record of transactions between entities on the network. When an entity wants to establish a transaction with another entity on the network, the initiator announces the intent on the network. This intent is propagated throughout the network and when everyone approves the transaction takes place and is recorded with all its details into a block. This block is added to the existing chain of blocks and is communicated to all nodes on the network so that every node has a copy of the entire chain. For each transaction, both the initiator and the recipient create what is known as wallet that identifies them with the transaction. The wallets change for each transaction irrespective of the initiator and recipient in order to protect privacy. There are two broad categories of blockchains depending on the access viz. permissionless blockchains and permissioned blockchains. Bitcoins and Ethereum (see below) are examples of permissionless blockchains where anyone can join the network if they are able to solve certain cryptographic problem. Permissioned blockchains restrict

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