Chapter 21
Information Sharing for Manufacturing Supply Chain Management Based on Blockchain Technology

Kamalendu Pal
https://orcid.org/0000-0001-7158-6481
City, University of London, UK

ABSTRACT

Internet of Things (IoT) and blockchain technology-based information system (IS) can be used to improve tracking of goods and services in offering and build a collaborative operating environment among the business-partners of the manufacturing industry. In this process IS architecture plays an important role in storing, processing, and distributing data. Despite contributing to the rapid development of IoT applications, the current IoT-centric architecture has led to a myriad of isolated data silos that hinder the full potential of holistic data-driven decision-support applications with the IoT because of technical issues (e.g., standalone IoT applications suffer from security and privacy-related problems). This chapter presents a proof of concept of a hybrid enterprise information system architecture, which consists of IoT-based applications and a blockchain-oriented distributed-ledger system to support-transaction services within a multiparty global manufacturing (e.g., textile and clothing business) network.

INTRODUCTION

In recent decades, many global manufacturing industries, such as automotive, pharmaceutical, apparel, consumer electronics, started to operate globally in extending the geographical boundaries of their business operations. At the same time, global manufacturing business today appreciates the value and consequence of building an effective supply chain as part of organizational proliferation and profitability. A manufacturing supply chain is a cooperative business network of facilities and distribution options that

DOI: 10.4018/978-1-6684-7132-6.ch021

perform the functions of material procurement, the transformation of these materials into intermediate and finished products, and distribution of these finished products to customers (Pal, 2017). Supply Chain Management (SCM) aims at improving the allocation, management and control of logistical resources and their operational issues.

The operational structure of the manufacturing supply chain can vary from industry to industry. For example, there are a handful of computer manufacturers, but only a few microchips sellers dominate at their tier in personal computer manufacturing supply chain networks. The automotive industry has few final-stage assemblers, but many manufacturers for most parts. In recent year aircraft manufacturing giant – Boeing need to resynchronize its supply chain, and decisions made now by tier-three and tier-four suppliers will affect Boeing's 2021 production rate. Yet uncertainty makes decision-making difficult for owners and executives in the supply chain. This results in 'mixed supply-based' approach in the manufacturing industry. The actual application of a mixed supply-based approach has been established in the textile and clothing industry. Thus, rather than contracting either cost-effective overseas manufacturers or responsive domestic suppliers, the mixed supply-based approach can be used to optimize the manufacturing supply requirements and supplier selection is often driven by corporate policy and market demand.

Much manufacturing company product and service operates in supply chain networks that interconnect hundreds of suppliers, wholesalers, logistics service providers, and distribution channels with physical operations located around different continents. The operational environment in which global manufacturing businesses are collaborating with their suppliers and customers have recognized interoperability of information systems as importance. The need to address this change becomes even more important when considering that new paradigms such as the Internet of Things (IoT) and its ability to capture real-time information from different aspects of manufacturing business processes by using RFID tags and sensors-based data communication networks. In this process enterprise information system architecture plays an important role in storing, processing, distributing data and relevant information.

Despite the growing potential to apply IoT in manufacturing supply chain management systems, there are many challenges need to be resolved. For instance, IoT-related technical issues experienced when operating at the whole manufacturing business level, such as security, authenticity, confidentiality, and privacy of all business-partners. From an IoT vulnerability perspective, practitioners and academics consider security to be the most important issue. Existing security solutions are not well suited because current IoT devices may consume a significant amount of energy and may have significant information processing overhead. Also, problems such as counterfeiting, physical tampering, hacking, data theft might raise trust concerns among manufacturing supply chain business partners.

Appropriate protection must be developed to leverage the value and enhance the trust of connected IoT devices in manufacturing supply chains. For example, blockchain technology now offers several potential solutions to address known issues related to IoT. A blockchain is a distributed network for orchestrating transactions, value, and assets between peers, without the assistance of intermediaries. It also commonly referred to as a 'ledger' that records the transaction. Another way to view a blockchain is as a configuration of multiple technologies, tools and methods that address specific problems. With the adopting of blockchain technology, manufacturing businesses aim to enhance information transparency and improve trust in their supply chains while supporting the interoperability among the networked supply chain exchange partners. As a result, it has gained considerable attention from academics, practitioners, manufacturers who seek to combine IoT with other technologies. At the same time, developments are in progress to integrate blockchain technology with IoT solutions, leading to novel structure of modern