Chapter 5
A Review of Big Data Analytics for the Internet of Things Applications in Supply Chain Management

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ABSTRACT

The internet of things (IoT) presents opportunities that enable communication between virtual and physical objects. It produces new digitized services that improve supply chain performance. Moreover, artificial intelligence (AI) techniques resolve unpredictable, dynamic, and complex global product development and supply chain-related problems. In this operating environment, heterogeneous enterprise applications, either manufacturing or supply chain management, either inside a single enterprise or among network enterprises, require sharing information. Thus, data management and its analytical interpretation have become a significant drivers for management and product development in networked enterprises. This chapter describes an information systems framework for the global product development purpose, and it also highlights how businesses can use business intelligence from gathered data from IoT applications. Finally, the chapter describes important categories of Big Data analytics applications for the supply chain operations reference (SCOR) model, and it also presents a data processing framework for supply chain management (SCM).

INTRODUCTION

Commercial trading between different countries and across various continents has started since ancient times of human civilization. In the early days of civilization, cross-border trade happened mainly for goods such as rice gain, wheat, spices, textile, metals, petroleum products, and other essential commodities. Through the Silk Road, the Spice Route, and various other interconnected trade transportation

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networks, human civilizations have initiated trade patterns that have blossomed with industrialization and globalization (Bardhan, 2003) (Stiglitz, 2017).

While the central precept of global trade is simple and unchanged to move goods and money from point A in one country to point B in another country, however in reality, it is much more complex to deploy this business practice. Its activities include financing trade, tracking and tracing goods within supply chains, and verifying the quality of those goods through provenance and product pedigree. As global trade has grown in scale, operational business processes have become more numerous and complex. In addition, these business practices strain to accommodate the demands of increased trade volume among more participants – business financiers, partners as importers and exporters servicing different market segments, freight forwarders, customs and port authorities, regulatory governing bodies, and insurance providers. In this way, business communities realize and appreciate the concept of supply chain operations, their respective values, and their management from ancient times. Consequently, supply chain management and automation of its business operations demanded more priority in corporate strategy formation and execution.

With the advent of technological innovation, intelligent applications such as smart factories, self-decision-making machinery in manufacturing plants, and intelligent supply chain equipped with *various sensors* and radio frequency identification (RFID) tags are making regular operations smarter. These smart applications require a vast amount of data and transmit data that generate a high traffic volume, making businesses' ability to modern data analytics essential. On the other hand, *artificial intelligence* (AI) based algorithms can be utilized to resolve unpredictable, dynamic, and very complex problems to yield suitable business decisions. Recently, researchers have shown immense interest in enhancing the business's overall performance with modern information system architecture (ISA) and software system technology (SST).

The SST, particularly *data analytics*, is now significantly impacting the manufacturing industry. However, manufacturing professionals have been slow to exploit the full potential of SST. Instead of using SST to maximize productivity and revenue-generation ability, SSTs have been used mainly for *enterprise resource planning* (e.g., accounting, inventory management, human resource management) purposes within the manufacturing industry. As a result, the manufacturing industry has yet to exploit SST as an effective tool.

In addition, the advantage of globalization has simulated different initiatives in global product manufacturing and marketing business activities. For example, in the 1980s, the "*quick response*" strategy was developed to maintain a competitive advantage (Porter, 1985) for the domestic manufacturing of products. Technological innovations have made fast electronic communication a global phenomenon (Pal, 2022), and the rapid acquisition of technical skills in various countries has meant that many professional tasks could be outsourced (quality control, raw materials purchasing, sample making). Researchers (Gereffi, 1999) (Pal & Yasar, 2020) identified some of the trends in the manufacturing business. Also, the globalization trends have continued, and the radical social reform idea of making more from fewer resources (known as *Gandhian Engineering*) (Prahalad & Mashelkar, 2010) has become the business rule in today's global market. Also, operational planning – and appropriate information system (IS) – drives the whole business, where customers play a pivotal role.

With technological advances, manufacturing companies regularly employ data mining techniques to explore the contents of data warehouses looking for trends, relationships, and outcomes to enhance their overall operations and discover new patterns that allow companies to serve their customers better. This way, manufacturing organizations rely on business processes related to data to formulate strategy