

## Chapter 4

# Radio Frequency Identification Technology and Its Security Concerns in the Manufacturing Industry

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### **ABSTRACT**

*The advent of Radio Frequency Identification (RFID) technique, low-cost wireless sensor devices, and web-based technologies are ushering new ways to take control of the plethora of data created by the Internet of Things (IoT) approach has gained popularity in the modern manufacturing industry. This mechanism provides an opportunity of remotely storing and retrieving data from RFID-tags. Products labelled with such tags can be scanned efficiently using RFID-readers that do not require line-of-sight. This type of identification and access to information on tags are used by manufacturing business operations, can lead to improving logistics, and better customer service. However, the widespread use of RFID technology also introduces serious security and privacy risks since the information stored in tags can easily be retrieved by hidden RFID-readers, eventually leading to the violation of genuine business operation privacy. This chapter discusses the open research challenges of RFID applications in the manufacturing supply chain operations.*

### **INTRODUCTION**

All businesses today understand the value and importance of building effective supply chains, as part of sustainable growth and profitability (Pal, 2019). In many global manufacturing businesses, such as automotive, pharmaceutical, apparel, consumer electronics, multitier supply chains, with different business-partners at different tiers of the chain, are common (Corbett & Karmarkar, 2001). Moreover, the operational structure of manufacturing supply chains can vary substantially. For example, there are handful of personal computer manufacturers, but only few microchips sellers dominate at their own tier.

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The automotive industry has few final assemblers, but many manufacturers for most parts. However, the exact interactions between structural components, their pricing mechanisms, and entry and production decisions are very important for manufacturing companies. These production decisions are mostly based on day-to-day business operational information.

A manufacturing supply chain consists of interconnected activities, and their associated business processes together to provide value-added service to its customers. Customer-engaged manufacturing companies, from automobile to highly critical fighter aircraft makers, always need different stakeholders' information for their supply chains. An entire network of manufacturers and distributors, transportation and logistics agencies, financial institutions, warehouses and freight-forwarders work together to make sure that the right goods and services are available at the right price, where and when the customers want them. Having supplied value-added services (e.g. products and associated customer services), the supply chain does not terminate. The supply chain is comprised of several steps from the front end, through the customer request, supply chain order processing initiation, quality assurance assessment for products and services, relevant training processes for staffs, customer support facilities, to maintenance and replacement facilities. Manufacturers are investing in state-of-the-art operational practices to optimize both cost and efficiency to their supply chain.

In a typical supply chain, raw materials are purchased from suppliers and products are manufactured at one or more production plants (Pal, 2017) (Pal, 2018). Then, they are transported to intermediated storage facilities (e.g. warehouse, distribution centers) for packing and shipping to retailers or customers. The path from supplier to customer can include several intermediaries such as wholesalers, warehouse, and retailers, depending on the products and markets. In this way, supply chain management relates to business activities such as inbound and outbound transportation, warehousing, and inventory control. Importantly, it also embodies the information systems necessary to monitor these business activities. Figure 1 presents a simple diagrammatic representation of a manufacturing supply chain, which consists of two separate legal entities, a retailer and manufacturer. The retailer owns the first two nodes on the left-hand-side of the diagram, which consists of the retail store and the retail distribution center; and the manufacturer owns the last two nodes, the manufacturing distribution center and the plant.

Moreover, all supply chains share the following characteristics: (i) the supply chain comprises all business activities in order to supply a product or service to its end-customers; (ii) any number of supply chain partner organizations can be linked in the supply chain; (iii) a customer can be a supplier to another customer within the supply chain, which means that the total network of activities can consists of a number of suppliers / customer relationships; (iv) the path from supplier to customer, depending on the products and markets, can include a number of intermediaries (distributors) such as wholesalers, warehouses, and retailers. Products or service flows from supplier to customer are called downstream flows while demand information from customer to supplier is called upstream flows.

*Figure 1. Diagrammatic representation of a supply chain*



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