Chapter 1
A Literature Review of the Emerging Field of IoT Using RFID and Its Applications in Supply Chain Management

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ABSTRACT

The Internet of Things (IoT) envisions an ecosystem where smart and interconnected objects can sense surrounding changes, communicate with each other, process information and take active roles in decision making. Optimizing supply chain performance is a primary concern of manufacturing and logistics organizations. Radio Frequency Identification (RFID) is helping organizations to build automated and interconnected smart environment by object identification and tracking, motivating the first step towards an IoT-enabled world. This chapter attempts to understand extant literature studying applications of RFID in implementing the IoT in supply chain management. We categorize extant literature, firstly, based on research methodology and secondly, based on supply chain processes. We find that presently academic activity is around conceptualizing the usability of RFID in the IoT with limited analytical and empirical evidence. Supply chain processes such as demand planning, procurement, retail shelf space management and product returns are prospective areas for interesting future research.

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INTRODUCTION

Today's world consists of smart objects (e.g. smart mobile, smart AC etc.) that have the capability to sense surroundings, capture certain signals about changes and communicate their presence to other smart devices. There has been a revolution in the product design leveraging the power of information technology. Massive computation capability, network flexibility, usage of electromechanical components have provided new dimension in product specification. In this new world, products not only perform what they are supposed to but also perform additional activities like intelligent assessment and self-adjustment based on surrounding changes. This smart-connected object eco-system has brought new challenges and opportunities (Porter & Heppelmann, 2014). In light of the rapid emergence of smart products and possibilities, the term Internet of Things (IoT) was coined by MIT in the late 1990's. IoT means "devices or sensors connected world" where things i.e. the smart objects can communicate, monitor surroundings and take necessary steps to complete certain tasks managed by some external agency or by the connected devices depending on the application context. Thus smart objects are connected and integrated virtually and seamlessly by information technology so that the real world can be more accessible when necessary (Atzori et al., 2010; Uckelmann et al., 2011). Applications of smart objects connected through internet in industry oriented applications e.g. telemedicine (e.g. smart medical devices), utility (e.g. smart meter) has made IoT popular and practitioners are considering the possibilities of applying smart connected devices in other industries (e.g. supply chain, automobiles etc.).

One of the technologies that is driving the vision of IoT is Radio Frequency Identification (RFID). RFID is a technology for automatic identification of any device and capturing data stored in embedded microchips. A RFID tag is a chip attached to any object whose position is to be tracked. RFID system consists of an antenna to communicate with scanning devices that can read the chip information remotely, a reader that emits radio signal and receive information for tags, a middleware that bridges RFID hardware with enterprise applications (McFarlance & Yossi sheffi, 2006). Each RFID tag consists of a unique code which identifies the object it is attached to. Global standard for this code is EPC (Electronic Product Code). EPC codes can be of different length. A real life analogy of EPC code is our mobile number which can identify the consumer, network types, location of a person or service provider details. An EPC of 96 bits can identify more than 268 million manufacturers, more than 16 million types of objects and almost 69 billion articles for each manufacturer (Brock, 2001). This unequivocal ability of contactless communication, surrounding information capture, presence of real time centralised processing and unified view of objects give rise to numerous potential applications across different domains.

In this chapter, our objective is to review different applications of IoT using RFID in the domain of supply chain management. A supply chain is a system consisting of organisations, people, material, information, activities and other resources involved in moving a product or service from supplier to customers. In other words, a supply chain is a complex network of suppliers, manufacturers, warehouses, distribution centres, retail outlets that work collectively to provide products or services to the end customers (Wikipedia, 2016). Supply chain management encompasses the planning and management of all activities involved in sourcing, procurement, manufacturing and distribution. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies (CSCMP, 2016). The Supply Chain Operations Reference model (SCOR) is the world's leading supply chain framework, linking business processes, performance