

Chapter 8

Review of RFID Applications in Perishable Inventory Management

Linh Nguyen Khanh Duong

Auckland University of Technology, New Zealand

Lincoln C. Wood

Auckland University of Technology, New Zealand & Curtin University, Australia

Xiaowei Wang

Auckland University of Technology, New Zealand

ABSTRACT

Radio frequency identification (RFID) technology, which enables real time data collection, has been proposed as a promising solution in perishable inventory management. Research shows that RFID technology has many benefits for perishable products; therefore, this chapter presents an overview of RFID technology and its applications to perishable inventory management. The findings provide a comprehensive review and support the managers in evaluating an investment decision to implement RFID and employ RFID in inventory management for perishable products.

INTRODUCTION

Perishable product inventory management has been an attractive research area and has received attention for many decades (Bakker, Riezebos, & Teunter, 2012). Managing inventory for perishable and non-perishable products is different because the perishable products depreciate the value over time. That depreciation reduces the benefits to the society (e.g., less revenue, more wastage, and less product quality). For example, the temperature in a warehouse can reduce the quality of coffee thus decreasing the value of that coffee. Consequently, the consumers do not have the best coffee quality, and manufacturers do not earn the expected revenue.

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Moreover, companies usually provide product categories (e.g., product size and flavour) to meet variant demands. The high numbers of categories increase the difficulty of inventory management such as the difficulty in controlling quality for each unit of product or checking the number of products in the warehouse. Expired product is an additional problem in managing inventory. A report conducted for the international congress “Save Food!” states that in industrialised countries, more than 40% of food is lost at retailers and consumers (Gustavsson, Cederberg, Sonesson, Van Otterdijk, & Meybeck, 2011). Considering these difficulties, Pahl and Voß (2014) suggested that the development of technology helps to collect information and improve inventory management for perishable products (e.g., reduce wastage, improve customer satisfaction, and increase profit margin).

Technology collects information of products in warehouses (e.g., information about quality and age) and helps to solve the challenges in managing inventory for perishable products (Kärkkäinen, 2003). Data relating to products in warehouses provides information about quality status, and then the managers decide to issue which product first to avoid expiration. Another benefit is the replenishment timing and accuracy that is improved because the quantity of availability product in warehouse is known exactly and quickly.

Radio frequency identification (RFID), which enables automatic real-time data collection, is a promising revolution in supply chain management and inventory management. It is widespread in applications (e.g., retailing, manufacturing) and has received much global attention. Major retailers and manufacturers are testing and implementing RFID in their businesses. Wal-Mart reported that RFID reduces stock-out situation by 21% and reduces manual orders; Metro Group saves labour cost and time by using RFID (Leung, Cheung, & Chu, 2014). Research states that RFID keeps perishable products fresh through better management (Roberti, 2005). RFID can combine and transfer more product data (e.g., data of temperature, humidity). RFID readers can also distinguish between several tags without human intervention (Kumar, Reinitz, Simunovic, Sandeep, & Franzon, 2009). In summary, RFID technology brings benefits to the whole supply chain and retail sector in particular (Hingley, Taylor, & Ellis, 2007).

This chapter presents an overview of RFID technology and its applications to perishable inventory management. The findings provide a comprehensive review of the application of RFID technology to perishable inventory management and support managers in evaluating RFID implementation. The results support the managers in making RFID investment decisions and using RFID technology in inventory management systems. With those objectives, the chapter is organised as follows. The first section introduces RFID technology such as RFID readers, tags, and antennas. The second section reviews the application of RFID to perishable inventory management based on three main classifications: time-temperature information, products’ quality, and inventory accuracy. The third section reviews the challenges and the evaluation of RFID investment. The final section concludes and presents the results of this chapter.

BACKGROUND

Traditionally, many companies use barcode in automated and standardised system in warehouses. A barcode is optical machine-readable data about an object or a product (Sriram, Rao, Biswas, & Ahmed, 1996), and originally barcodes represented data by the width and spacing of parallel lines. Barcode scanning reduces manual errors in handling data and supports managing inventory; particularly, it helps to

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