

# Inventory Shrinkage and Corrective RFID and Management Strategies



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## INTRODUCTION

### RFID-Related Technologies in Operations and Inventory Management

There have been numerous investigations to investigate the benefits of radio frequency identification (RFID), especially in retail and operational situations. A number of more traditional studies have focused on the effects that RFID has on supply chain performance, in particular inventory management and its control to prevent losses from theft. This contribution inspects some of this literature and empirically tests perceptions of inventory management on its effectiveness, especially in regard to inventory shrinkage controls. In general, a plethora of literature has been written on the general overview of automatic identification and data capture technologies (AIDC), especially RFID-based solutions, and how such technologies can be applied within supply chains, the benefits that it brings to firms, managerial guidelines around using it, and how to implement them (Devaraj, Fan, & Kohli, 2002; Dutta, Lee, & Whang, 2007; Zang & Fan, 2007). There have been recent writings made on its effects in the area of finance, inventory, and manufacturing (Aldaihani & Darwish, 2013; Azadeh, Gholizadeh, & Jeihoonian, 2013; Bhamu, Khandelwal, & Sangwan, 2013; Fumi, Scarabotti, & Schiraldi, 2013; Ketikidis, Hayes, Lazuras, Gunasekaran, & Koh, 2013; Mateen & More, 2013; Park & Min, 2013). In particular, Visich, Li, Khumawala, Basheer, and Reyes (2009) focused on the review and classification of existing quantitative empirical evidence that has been gathered for RFID on supply chain performance. The evidence was separated out into two sections, which included processes and effects. The processes were further broken out into operational and managerial, while the effects were broken out into automation-related, informational, and transformational. Operational processes, as it relates to the RFID applications generally include labor cost reductions, improved reliability and efficiency, and reduced throughput and inventory costs. Management processes typically include administrative decisions, process control, reporting, and routine. Automation-related effects are related to the value that comes from making a process more efficient. Informational effects are those that are due to the ability of the technology to gather, store, process, and distribute information. Transformational effects are those that create innovation or transformation through technology.

Visich, et al. (2009) only focused on metrics that were based on actual results that were reported from a pilot study or through actual implementation (i.e. empirically tested). To make the study more focused, they omitted cases where multiple metrics were employed. These omitted metrics included estimated benefits or benefits that were masked to protect confidentiality, results from unidentified companies (unless the results were significant), results that were difficult to separate due to phased implementations of information management systems and RFID, and aggregated evidence from multi-year implementations across all of a company's facilities. By inspecting the data via a process-oriented framework (i.e. immediate and on-going operational benefits from enterprise resource planning implementations), they found

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that the empirical evidence reflected that the major effects from implementing RFID within supply chain management were automation-related effects. These effects were on operational processes via inventory control and efficiency improvements. This is followed by informational effects on managerial processes via improved decision quality, production control, and effectiveness of retail sales. The evidence for informational and transformational effects on operational processes was very limited. Similarly, the evidence showed that there were no automation-related or transformational effects for managerial processes. The empirical evidence showed that the major effects of RFID on supply chain performance are automation-related effects on operational processes and informational effects on managerial processes.

## **Supply Chain and Inventory Management Applications**

There are many case studies of the benefits to SCM and inventory control brought forth through the implementation of RFID tags across a variety of industries, in order to identify the key benefits of implementing the program in highly differentiated industries. Such research generally has its major goal to develop a working model that may be useful to the process of identifying key benefits of RFID implementation across industries. RFID-related technology domestic sales exceeded US\$7 billion in 2008 and are expected to continue increasing for the foreseeable future (Mehrjerdi, 2011). As such, many firms are looking to implement the technology to their advantage by reducing inventory or supply chain costs, increasing efficiency in delivering products or services, increasing anti-theft or other security precautions, and/or to allow them the tools necessary to offer distribution through large retailers, such as Wal-Mart, or to become suppliers of large purchasers, such as the U.S. Department of Defense.

RFID tags have been used for several decades, are comprised of a silicon chip and separate antenna, and consist of four types: Passive, semi-passive, semi-active, and active. Passive tags require an external power source from the tag reader while active tags are powered internally via a battery with semi-passive and semi-active using a battery to power either the antenna or the chip, respectively. The major improvements offered by RFID from the barcode are the capability of holding much more data, 96 bits or more versus 16 bits, the capability to read multiple tags simultaneously, and the ability to utilize dynamic data that can be rewritten as deemed necessary (Ustundag, 2010; Wyld, 2006; Yao & Carlson, 1999).

The implementation of RFID provides many benefits to SCM, inventory, and scheduling through its greater capacity to store dynamic information allowing this data to reflect where the item is located in both a physical location and as a function of its completeness. RFID allows companies to better regulate procurement in a JIT manner so that inventories may be kept low and process management can become more efficient. By permitting data to be transferred relating to the quality aspects of a product such as expiration dates and holding temperature for food products. When RFID techniques are applied to a retail sector, data quality aspects may be transferred to functions of time, as styles fluctuate with the seasons (Smith & Rupp, 2013), or to functions of multiple other aspects allowing for fast and easy identification of products requiring removal from inventory to avoid obsolescence or shrinkage (Smith, Smith, & Baker, 2011). Benefits can be found through stop-loss accountability and anti-theft as the RFID tags are typically easy to embed and simple to monitor past endpoints such as exits or trash disposals, eliminating waste from accidental disposal or theft.

Indirect benefits of RFID implementation typically include those informed in part on information gathered from implementation. It is hoped by management that by monitoring workflows and throughputs, it will be possible to redesign and better integrate manufacturing or services processes to eliminate waste from excess time in non-value added tasks such as storage or queuing. It is also possible to re-

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