# Improving Internal Controls Over Inventory With Radio Frequency Identification Technology

John R. Leavins, University of St. Thomas, USA
Vinita Ramaswamy, University of St. Thomas, USA

## ABSTRACT

*Radio frequency identification (RFID) is a rapid growing technology that is transforming the way organizations track inventory and other tangible assets. When a company adopts RFID technology, it attaches tags to inventory items or other assets. These tags can be used to locate these items by using radio signals. The Committee of Sponsoring Organizations (COSO) established three objectives of an effective internal control system. Under COSO, a good internal control system should promote reliable financial reporting, the effectiveness and efficiency of operations, and compliance with laws and regulations. The implementation of RFID technology to track inventory can have a significant impact on accomplishing these objectives. Accountants, auditors and management should be familiar with RFID technology and understand the impact of RFID deployment on a company's internal control structure. The purpose of this paper is to summarize the basics of RFID technology and examine how RFID technology can improve a company's internal control over inventory. The advantages and disadvantages of RFID technology will also be summarized.*

**Keywords:** RFID Technology; COSO Framework; Internal Control; Inventory

## INTRODUCTION

Radio frequency identification (RFID) can offer significant improvements in an organization's ability to track tangible assets. It is particularly important in tracking inventory since inventory often makes up a substantial portion of a corporation's assets. In addition, inventory is many times difficult to track since it is frequently housed in different locations and often moved. Because of cost considerations, organizations have been hesitant to implement RFID systems. However, the cost has been declining rapidly and the growth in RFID technology is likely to continue.

The COSO (Committee of Sponsoring Organizations) framework for internal control states that management has three broad objectives in designing an effective internal control system. The internal control system should provide reasonable assurance regarding the reliability of financial reporting, the effectiveness and efficiency of operations, and compliance with applicable laws and regulations. The purpose of this paper is to describe RFID technology and discuss how it can be used to track inventory. The paper also shows how the adoption of RFID technology can substantially contribute to the accomplishment of COSO's three control objectives.

## TRANSITION FROM BARCODES

Most merchandise sold in the United States is tracked with a 12-digit universal product code (UPC). This code is imprinted on inventory items and referred to as a barcode. Initially, barcodes were designed to expedite the handling of inventory in grocery stores. The barcodes helped track the inventory and also made the checkout process faster. Because they were so successful in improving the tracking and handling of inventory, barcodes were quickly adopted by virtually all retail industries. When an item that contains a barcode is scanned at a checkout counter, the

data contained on the barcode is transmitted instantly to the company's computer and the inventory master file is updated. The barcode system was a major advance in the management of inventory and greatly enhanced perpetual inventory systems.

An RFID system serves the same purpose as a barcode system but offers many additional advantages. A radio frequency identification system consists of an antenna, a transponder and a transceiver. The transponder is essentially a tag that can be attached to the inventory item. Most RFID tags are about the same size as barcode labels. The tags are encrypted with a microchip that is attached to a tiny radio antenna. The chip will typically store about two kilobytes of information. The RFID tags are activated with a device called an interrogator. When the tag passes through an area that is magnetized, the reader transmits a signal that is picked up by the tag. The reader then reads the data on the tag and transmits it to a computer. Special software installed on the computer then converts the data into useful information for management.

## ADVANTAGES OF RFID SYSTEMS

A major advantage of RFID tags over barcodes is that barcodes require the item to be in the line-of-sight whereas RFID systems can track tagged goods wirelessly. In addition, RFID tags are less easily damaged than barcodes. A radio frequency identification system does not require a person to manually scan a label. Also, RFID scanning can accomplished at a much greater distance than barcode scanning. The technology allows employees to see products in near real-time without human intervention. They also offer much greater data storage.

In an RFID system, inventory that is shipped to a company can be automatically read as it arrives at a warehouse. The inventory is then tracked as it moves to storage and is further tracked as it is sold and loaded for shipment to a customer. The inventory levels are automatically updated when the item is sold. Another advantage of RFID tags is that inventory items can be read and verified without even opening the boxes that contain the items. RFID technology thus provides companies with the ability to accurately track goods from acquisition to disposal.

## THE COSO INTERNAL CONTROL FRAMEWORK

In response to a number of scandals that took place in the late 1970's and early 1980's, the Treadway Commission was formed in October of 1985. The Treadway Commission was named after James Treadway, a former member of the Securities and Exchange Commission. The Treadway Commission's mission was to identify causal factors and make recommendations to address fraudulent financial reporting

The Treadway Commission recommended that a committee be formed to develop an integrated model that could be used to provide guidance on internal control. As a result of this recommendation, a committee was formed with representatives from five professional organizations. These were the American Institute of Certified Public Accountants, The American Accounting Association, the Institute of Internal Auditors, the Institute of Management Accountants, and the Financial Executives International.

The framework that emerged from this committee quickly became the most widely accepted internal control framework in the United States. Since the model was developed by the five professional organizations mentioned above, it is commonly referred to as the COSO model (Committee of Sponsoring Organizations).

The committee identified five elements or components of internal control that a good system of internal control should address. These were the control environment, control activities, information and communication, risk assessment, and monitoring. In addition, the COSO model stated that a good system of internal control should accomplish the following three objectives:

1.      It should provide reasonable assurance regarding the reliability of financial reporting,
2.      It should promote the effectiveness and efficiency of the company's operations, and
3.      It should promote compliance with applicable laws and regulations.

        

RFID technology can significantly improve a company's ability to accomplish these objectives with respect to inventory.

## IMPROVING THE RELIABILITY OF FINANCIAL REPORTING

One objective of internal controls under the COSO framework is to promote the reliability of financial reporting. For many retail or wholesale businesses, inventory represents the largest account in the financial statements. Due to the magnitude of the inventory account, it is extremely important that the account be valued as accurately as possible.

The most accurate method of assigning the proper costs to inventory items is the specific identification method. In the past, specific identification was usually used for large, low-volume, high-priced, easily traceable items. This was because of the expense of tracking large inventories with a high volume of transactions. The use of barcodes allowed for the expansion of the specific identification method to many more businesses because it improved the ability track individual items. However bar codes do not allow a retailer to track a particular item contained in a box of items from the time it is received until the time it is sold. RFID tags can be read without removing the items from the cases or boxes.

Although accounting principles allow for both periodic and perpetual inventory systems, perpetual systems allow for a constantly updated record of inventory on hand. Radio frequency identification tags greatly improve the precision of perpetual inventory systems. With an RFID system, each item is tagged and the tag transmits relevant information such as the cost of the item, its product code, and the date acquired. This system allows for precise tracking and accounting for the company's merchandise inventory. When an item is sold, the correct cost can be booked and a more accurate cost of goods sold, gross profit and net income can be calculated. RFID thus provides an optimal way to meet the objective of providing more reliable financial reporting.

## PROMOTING EFFICIENCY AND EFFECTIVENESS OPERATIONS

Another major objective of the COSO framework is to improve the effectiveness and efficiency of the entity's operations. RFID systems allow companies to reduce inventories and at the same time guarantee that products are in the right place at the right time. Effective supply chain management requires management to meet customer needs through efficient use of resources. This includes effective and efficient management of inventory. Since RFID technology gives business the capability to track goods throughout the entire supply chain, it enables an entity to lower its supply chain costs. Also, managerial decision-making is based on an accurate flow of inventory since it is possible to identify both the cost of ending inventory and the inventory that has been sold.

In a barcode system, the item must be within approximately twelve inches of the scanner. Personnel must be careful that no physical object is between the item and the scanner. If an inventory manager has a case of merchandise, he or she must unload the case, scan each item, and then repackage the case. This interaction can result in increased labor costs and the possibility of damage to items. In an RFID system, the transceiver transmits information on the tags to the computer. A person can simply take a small transceiver and move it near the items to be counted. The process is very quick and no items need to be removed from the boxes. The process is more accurate and damage to inventory is minimized.

There are other ways that an RFID system can also result in reduced labor costs. A significant amount of time can be saved with the expedited scanning process. In a barcode system, a worker would typically sort through items in a warehouse, scan the bar code, and then manually write down the count of items. With RFID technology, a worker can simply stand in the warehouse and instantaneously collect the information with a transceiver.

A well functioning RFID system can also help companies monitor inventory levels. Transceivers can be placed at various places in the store or warehouse and management can be alerted to inventory levels and restocking needs. Cost-savings can be realized because companies could employ fewer personnel to monitor inventory levels. With an RFID system, a retailer can ensure that its inventory is available to meet consumer demand. This tracking system allows retailers the ability to control costs and reduce its investment in inventory.

Another major benefit of an RDID system is the reduction of inventory theft. The system captures the inventory as it arrives from the supplier and then tracks it throughout its lifetime in the company. An RFID system can immediately detect unauthorized removal of inventory.

## COMPLIANCE WITH LAWS AND REGULATIONS

A third objective of the COSO framework for internal controls is the promotion of compliance with laws and regulations. RFID technology can be particularly useful in assisting companies in their compliance with the provisions of the Sarbanes Oxley Act of 2002. Complying with the time constraints of the Sarbanes Oxley Act has created real challenges for many companies. Most large public companies use enterprise resource planning (ERP) systems. A key advantage of an ERP system is the use of a common database to store data for the various system modules.

Under section 409 of the Sarbanes Oxley Act, the linkage between the Sarbanes Oxley Act and ERP systems becomes extremely important. Section 409 requires companies to disclose information regarding material changes in the financial condition or operations of the company within four days. Section 409 highlights the need for a company's enterprise resource planning system to receive real-time data to comply with the rapid reporting requirements. If companies integrate RFID technology with their ERP systems, those ERP systems can quickly process the data collected by the RFID technology into information that can be used to comply with the Section 409 reporting requirements.

Section 302 of the Sarbanes Oxley Act requires the CEO and CFO to certify the reliability of published financial statements. The CEO and CFO must certify that they have (1) disclosed to the auditor and audit committee all significant deficiencies in the internal controls and any known fraud and (2) indicate whether or not there were significant changes in internal controls or other factors that could significantly affect internal controls and may need corrective action.

Since inventory and cost of sales often comprise a major portion of the financial statements, RFID technology should provide some comfort to the CFO and the CEO regarding the reliability of the inventory and cost of sales items on those financial statements. It should also provide some additional assurance regarding the reliability of the internal controls over inventory. Thus, compliance with the Sarbanes Oxley Act should be enhanced through the use of RFID technology.

## DISADVANTAGES OF RFID

One of the major concerns regarding the implementation of RFID technology is in the area of privacy. Many are concerned that an RFID tag may remain active after sale of a product. Since the tags can be very small, they might remain in an article of clothing after purchase. If the tags remain active, companies could feasibly track certain customer patterns. When the item is taken out of the store, the embedded tag could be read by anyone with a reader. Some have referred to the tags as "spy chips" because of their tracking capability. Even though the tags can be deactivated upon sale, some are concerned with the potential for abuse.

Viruses also present a potential problem for RFID systems. A computer virus or worm could infect the RFID tag because of vulnerabilities in the RFID software. The virus could then spread to other tags. The virus could cause major disruption and be very costly to the company. Companies would have to take added precautions to guard against viruses and worms.

There are some other practical limitations to using an RFID system. For example, a reader might not be able to read a tag behind certain objects because some materials, such as aluminum, block the signal transmission. Because of this problem, care must be taken so that electromagnetic interference does not occur. Another issue with RFID tags is reader collision. Reader collision occurs when the signals from two or more readers overlap. This could result in multiple reading of the same tag. To avoid signal interference, readers must be carefully deployed to minimize the overlap in RFID fields.

**62**                   *2013 The Clute Institute*

**CONCLUSION**

Companies can derive major benefits by implementing RFID technology. RFID systems can offer a strategic advantage for businesses because they can track inventory in the supply chain more efficiently and monitor tangible assets. RFID offers companies a significant opportunity to strengthen their internal controls over inventory.

However, it is important to recognize that there are many new challenges that companies will face when the system is implemented. It is important that companies use the technology wisely to derive maximum benefit. Also, many will continue to raise the ethical, moral, and practical implications of RFID implementation. Because of the significant internal control benefits that companies can achieve, the technology is sure to continue to grow. It is important, however, that industry work to address the concerns of users.

**AUTHOR INFORMATION**

**John R. Leavins**, Ph.D., CPA is Chair and Professor of Accounting at the University of St. Thomas in Houston, Texas His specialties are Accounting Information Systems and Auditing. E-mail: Leavinj@stthom.edu (Corresponding author)

**Vinita Ramaswamy**, Ph.D. is Professor of Accounting at the University of St. Thomas in Houston, Texas. Her specialties are Financial Accounting and Forensic Accounting. E-mail: vinitar@stthom.edu

**REFERENCES**

1. Altay, Nezih; Porcher Taylor, "The SOX-RFID Connection". *Supply Chain Management Review, 11*(7), 2007.
2. Hinkel, Nate, "State Firms Lead in RFID Technology", *Arkansas Business*. Journal Publishing, Inc., December 15, 2007.
3. Lin, P Paul; Brown, "RFID Deployment: Considerations for Accountants". *The CPA Journal*. New York State Society of Certified Public Accountants, August 2008.
4. Lin, P Paul; Brown, "Radio Frequency Identification and How to Capitalize on It". *The CPA Journal*. New York State Society of Certified Public Accountants. December 2006.
5. "RFID Improves Inventory Accuracy". US Newswire, 2008. *HighBeam Research.*
6. Reding, Kurt; Sobel, Paul; Anderson, Urton; Head, Michael; Ramamoorti, Sradhar; Salamasick, Mark; *Internal Auditing: Assurance & Consulting Service*, 2$^{nd}$ Edition, 2009, Institute of Internal Auditors.
7. "Report on the Committee on Sponsoring Organizations", 1992, www.coso.org
8. Sarbanes-Oxley Act of 2002, Pub. L, 107-204, 116, enacted July 30, 2002.

*2013 The Clute Institute*                   **63**

**NOTES**