Asset and Inventory Management in the Hotel Industry using RFID technology: An Experimental Study with Economic Analysis

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ABSTRACT

The ability to provide a cost-effective solution to improve hotel organizations efficiency through inventory management has made RFID technology one of today's most potential deployment technologies. Hotel organizations are invariably competing in assuring the service quality and are facing many challenges in terms of inventory management that directly impacts the overall customer satisfaction. The purpose of this study is to conduct an experimental research to investigate if RFID technologies can offer efficient and effective solution to manage asset and inventory in the hotel organizations. An experimental research was conducted by implementing RFID tags on assets and inventories and tracking those using receivers in a boutique hotel. A framework to install identification tags, touch points and RFID system was suggested. This study also examined the costs, maintenance and ROI (Return on Investment) of using RFID system for two years by doing an Economic Analysis and comparing with the traditional barcode systems.

Keywords: *RFID (Radio Frequency Identification), asset management, inventory management, experimental research, economic analysis.*

INTRODUCTION

Radio Frequency Identification (RFID) is a term used to explicate technologies that use radio waves for "identifying and tracking objects automatically" (Jones et al., 2005). This RFID system can store information of goods or a product and communicates and integrates this information by sending/ receiving radio signals to a software system (Lin & Lin, 2007; Smith, 2005 & Rundh, 2007). These technologies transmit the signals below the detectable light with frequencies called "bands" by intonation of electromagnetic waves (Oztaysi et al., 2009). Unlike Internet and wireless technologies, RFIDs started off with humble beginnings and have taken much longer periods for implementing them commercially. RFIDs can provide cost-effective solutions to improve organizations efficiency including the hospitality industry.

These technologies were first implemented in World War II when scientist Harry Stockman published an article where he refers this system as (IFF) a "friend or foe transponder identification system" (Rundh, 2007 & John, 1993). Later these systems were used as Electronic Article Surveillance (EAS) in the late 60s and early 70s for commercial purposes to prevent theft in stores, later in highway toll gates and automobile industry in the early 80s (Oztaysi et al., 2009& Jones et al., 2005). These technologies by 2005 have grown to a $3 billion industry and are projected to generate to a $25 billion industry by 2015 (Wyld, 2006).

The key components of RFID system (Fig 1) are its "*tags and readers",* tags carry the information and the reader obtains this information and transmits this to a middleware system. These tags are also referred to as transponders and are available in two categories called as "active tags and passive tags". Oztaysi et al., (2009) differentiates these tags as "*read and write, read only and write-once and read many*". These active tags contain its own power source to receive and transmit information while passive tags contain no power and are only used to transmit information (Oztaysi et al., 2009 & Wyld, 2006). The readers in an RFID system are used to receive data from the transponder i.e. active or passive tags.

RFID Tags   Sends & Receives
             Information

RFID
Reader

Computer
Information
System

Figure 1
RFID System

O'Conner (1999), Siguaw et al., (2000) and Nyheim et al., (2004) suggested that the use of technology may play a vital role for creating a strategic advantage and the efficient use of RFID technologies may bring a major source of competitive advantage for hotel organizations. Keeping up with new technologies such as RFID is vital for hotels as they may "improve speed, accuracy, efficiency and security of information" (Jones et al., 2004). Collignon (2005) stated that RFIDs have a significant potential in the hotel industry in the areas of "technology and capacity control, safety and security, assets and capital and human resource management".

It is found that many frequent travelers are familiar with these technologies and have used RFID enabled guestroom locks, kiosks, cashless payment systems and smartcards, tags and bands (Aluri & Palakurthi, 2009). These technologies can also facilitate hotels to maintain the assets and inventory which enhances service, experience and overall satisfaction of the customers. The value of using RFID technologies and their ROI (Return on Investment) over the years have been studied by many researchers and practitioners in supply chain, retail and manufacturing industries. Hotel industries have not explored how to implement these RFID systems effectively and efficiently in terms of asset and inventory tracking.

RFIDs for Asset & Inventory Management

In the past, researchers apart from hotel industry have stated that RFID technologies can be used to identify the "available inventories" and provide information of the assets in organizations (Kok et al., 2008; Hau & Ozer, 2007 & Atali et al., 2006). While inventory and system user errors do occur quite frequently, there are not many studies that have identified them. While the traditional inventory management methods presume to have 100% reliable information, in actual fact most hotels have only uneven guesstimates of actual inventory. In hotel or lodging literature there are very few studies that focus on implementing RFIDs for asset and inventory management.

Most of the literature in areas of production economics has identified the sources of inventory discrepancies as "shrinkage, misplacement of products and transaction errors". Atali et al., (2006) states that inventory control does not track the inventory or assets that are lost or stolen. Most of the times assets and inventory are not placed correctly for customers as employees don't have a "one best efficient way" of storing and managing them. In another research conducted by Hau and Ozer (2007) found that after implementing RFID technologies there is a reduction in the inventory shrinkage from a 10% to 66% of the common shrinkage. In view of the fact that RFID technologies can be used to identify multiple tags without manual labor there may be cost savings in using them.

Abell and Quirk (2002) found that the early adopters of RFIDs in organizations has a 2% to 7% increase in the revenue and at the same time total costs in supply chain has reduced by 3% to 5%. Hau and Ozer (2007) mentioned that the three major advantages in using this system are "savings, cost-reduction and shrinkage". Patnaik (2004) found that these technologies can bring rapid developments compared to barcode technology with higher gains in the ROI (Return on Investment). By replacing all items that carry a barcode that are managed manually, RFIDs technologies can track these items without human surveillance. RFID implementation solutions in terms of asset and inventory management have not been explored in the hospitality literature. This experimental research implements RFID in the hotel facility to explore ways to use this efficiently and predicts the ROI in using this system.

In the hotel industry, Collingnon (2005) suggested that in many luxury and upscale hotels, hundreds of thousands of dollars of assets such as "valuable paintings, high end furnishings, electronic equipment and fine china and silverware" can be tagged rather than protecting them 24/7. While saving on the costs of maintenance, these technologies can also reduce the costs of labor. Smart RFID tags can be used for auditing activities by tracking revenue-generating equipments by making sure value items are rightly placed. It also facilitates in tracking items that may need servicing, repair or replacement (Collingnon, 2005 & Patnaik, 2004). While protecting the assets and tracking the inventory through RFID technologies, hotel organizations can focus on providing efficient and effective service to its customers.

In large organizations with hundreds and thousands of employees, RFIDs can be used to tag and track employee uniforms and have those sent to laundry (Collingnon, 2005). RFID technologies can also be used for in-room assets so that hotels can make sure all the services are offered to customers in their allotted guestrooms. Collingnon (2005) explains that hotels can manage lost and stolen garments, linens and sheets using this system. It also facilitates in providing efficient laundry services to customers by reducing the "laundry bill discrepancies".

Economic Analysis

In the Introduction to Economic Analysis, McAfee (2006) explains two advantages in using this analysis; first to identify the distribution of goods and services, and secondly to indentify how "*scarce resources*" are allocated systematically. This analysis also suggests how the divergent changes in the "*laws, rules and interventions*" in the market will affect individuals and provide conclusions on how these changes are valuable collectively (McAfee, 2006).

Economic analysis is also a method to come up with assumptions of the outcomes by investigating different methods and applying them to encounter a problem when taking decisions (Manski, 2000). The economic analysis to implement RFID system compared to a traditional barcode system is completed using a five step approach.

Implementation of the RFID System

The five step approach used in this research is as follows:
a. *Process Mapping*: The study created a detailed process map that demonstrates how assets and inventory moves in the hotel facility.
b. *Technology Advantages and Disadvantages*: The study considered the advantages and disadvantages of using these technologies in the hotel industry. This study also investigated the benefits and challenges in using the RFID technology.
c. *Identifying Touch Points*: Touch points are identified to see where the assets and inventories need to be tracked.
d. *Time studies*: These studies are conducted to compare the time to do tasks manually by employees with the time to track them using RFID system. The study also calculated the time savings and accurate time representation of the task when this system is used compared to the traditional system.
e. *Implementation costs*: We determined the costs of implementing the RFID system and compared it with the traditional 2D barcode systems used in the hotel.

This experimental research was conducted at a boutique hotel in a major midwestern university during the summer of 2010. The RFID hardware used for implementation is: Sirit Reader, Alien Antennas, Passive tags, Dell Laptop installed with Sirit software. A value stream mapping was conducted to identify the touch points where the RFID readers have to be placed. The value analysis of individual inventory was prepared by analyzing the costs, savings and maintenance by comparing the traditional 2D barcodes and RFID system. The complete results and conclusions for this study will be published later in the beginning of 2011. The final paper will include complete economic analysis with ROI in using RFID technologies.

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