

# THE IMPACT OF RESIDUAL RFID LOGISTICS ON CONSUMER USE AND PURCHASE INTENTIONS

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## ABSTRACT

In today's global competitive environment, organizations face a variety of challenges. Many organizations are adopting radio frequency identification technologies (RFID) as part of their information supply chains. These technologies provide many benefits to the organizations that use them. However, how these technologies affect consumers and their willingness to adopt the technology is often overlooked. Many of these tags remain active after the consumers purchase them. These RFID tags, placed in a product for one purpose and left in the product after they have served that purpose, are residual RFIDs. Residual RFID technology can have many positive and negative effects on consumers' willingness to buy and use products containing RFID, and thus, on the business's ability to sell products containing RFID. In this study, we outline some of the advantages and disadvantages of residual RFID from the consumer perspective, then follow up with an in-depth survey and analysis of consumer perceptions.

**Keywords:** Technology Acceptance, Emerging Technological Challenges in the Business Environment, Risk, and Residual RFID.

## INTRODUCTION

Many organizations are adopting radio frequency identification technologies (RFID) as part of their information supply chains in order to stay competitive in a global environment. RFID technologies provide many benefits to the organizations including the improvement of the supply chain, inventory systems, customer relationship management, and the overall efficiency of the organization.

Organizations face a variety of challenges in today's global competitive business environment. Organizations thrive for continuous improvement as well as enhancing the entire supply chain in order to stay competitive. One of the ways an organization can deal with this situation is to study and apply the methods of supply chain management (SCM). The goal of SCM is to offer products at low cost with high customer satisfaction by managing production, procurement, distribution, and inventory control. The critical issues of SCM are to integrate the inventory, distribution and sales information and to make the integrated logistics information visible to the other organizations in the distribution and sales channels in real-time ([2] [5] [6] [7] [13] [14]). According to studies conducted by Prater, et al. [10] and Smith [11], RFID technology provides automatic data capture, data identification and information interchange. Therefore, merchandise tracking, product sorting, and distribution data collection and analysis can be efficiently accomplished.

It has been predicted that in the near future, the vast majority of the products manufactured, bought and/or sold will have a small tag that can remotely and uniquely identify that individual item. Any person or business with an appropriate scanner may be able to know the item type, price, where it was made, sold, purchased and resold by reading a small radio frequency identification (RFID) tag. RFID tags are currently being deployed in the supply chains of many organizations. These tags offer many benefits to organizations; however, many of these tags can remain active after they leave the organization, broadcasting their identities and histories to anyone with a scanner and link to the proper database. These left over tags, installed to help the supply chain, but not removed after the purchase, are referred to as residual RFIDs.

Residual RFID technology can have many positive and negative affects on consumers' willingness to buy and use products containing RFID, and therefore on the business's ability to sell products containing RFID. If consumers refuse to buy products with active RFID tags in them, the business harm is greater than the business benefit, regardless of any gain in supply chain efficiency.

While many researchers have looked at the benefits that accrue to corporations and supply chains through RFID technology, many organizations have not adequately considered the impact of residual RFID technology on consumers, business and society. The ultimate purpose of RFID technology is to provide retailers and suppliers with the ability, in time, to track any item remotely and uniquely at the individual level. The impact of this ability, both positive and negative, on consumers in our society will be enormous. Whether consumers are ready for it or not, RFID technology is becoming a part of their lives. Many of its applications have little to no effect on the general consumer; however, the integration of this technology into other aspects of consumers' lives raises certain concerns.

The study conducted by Lin, et al. [8] indicated that RFID technology can provide real-time data to make appropriate managerial decisions in the supply chain management systems since these systems are complex, dynamic, and stochastic. Caton [3] indicated that RFID has a major advantage in supply chain management; however, the organization should plan and test its successful implementation. The study also suggested that the focus of information technology should be on the supply chain since RFID will have a significant impact on all stages of SCM.

The two different types of RFID tags, active and passive, offer their own differing benefits and liabilities to consumers. Active RFID tags are driven by a power source, typically a small battery. These tags are capable of broadcasting their own signal over varying distances, depending upon the potency of the battery and range of the frequency. Although useful only for the duration of their power source, these tags may be extremely important in certain military and other applications, but may offer only limited practicality for consumer use, as the cost to produce such tags would render them prohibitive in a consumer environment.

Passive tags have no power source and are relatively inexpensive to produce. These economical tags are those that are most likely to be found on consumer goods. Lacking a power source, these tags are incapable of broadcasting their own signal. Initially, this sounds like a benefit in terms of consumer privacy, but the lack of a power source effectively makes these tags nearly immortal in consumer terms. They are activated only when scanned or read by a RFID scanning device. Such activation may occur at a retail location, airport security checkpoint, bus terminal, restaurant, mall, or as the result of a handheld scanner that could be used unobtrusively at any time or place. Active tags have limited life span, but passive tags are forever. These passive tags are the tags that become residual RFID tags.

The benefits of RFID technology in business and governmental applications have been well documented, as have the security and privacy risks associated with the technology for consumers. The benefits of RFID technology for consumers, however, are often overlooked. Yet it is imperative consumers understand that there are legitimate consumer benefits associated with the use of this technology. Without realizable consumer benefit to counteract the perceived risks associated with RFID, retailers will find it difficult to maintain a solid customer base in the face of the perceived security and privacy risks.

While consumers may realize legitimate benefits from residual RFID, the liabilities likewise cannot be ignored. Spiekermann and Ziekow [12] suggest that five immediate and key threats of RFID technology are:

1. Unauthorized assessment of one's belongings by others
2. Tracking of persons via their objects
3. Retrieving social networks
4. Technology paternalism
5. Making people responsible for their objects

The most obvious violation is perhaps the first listed by Spiekermann and Ziekow [12]. They suggest that "by scanning inventories of flats and houses or baggage at airports promising targets for theft or burglary might be identified." They also suggest that individuals may be tracked by others through the objects they carry [12]. The offending party may be an individual, organization, or government. In addition, businesses could potentially target individuals with personalized advertising both in-store and out based upon objects they carry. While businesses may desire such efficiency in advertising, many consumers may view such efforts as intrusive.

Cazier et al. [4] state that privacy risk factors are found to negatively influence consumer intentions. If a consumer perceives a particular privacy or security risk as a result of residual RFID, that perception could profoundly affect that consumer's intention to purchase a particular product carrying a RFID tag or engage in commerce with a retailer that utilizes RFID technology.

It should also be noted that when people perceive risks, they change their behaviors accordingly, often by performing a risk benefit calculation that assists them in deciding whether they should or should not

disclose private information [9]. But in the case of RFID, that choice to disclose or not disclose may not be available. Whether it is the retailer's scanning of purchased goods or the illicit scanning by would-be thieves, consumer purchases will be tracked, catalogued, and evaluated for further action.

In this study, we outline some of the advantages and disadvantages of residual RFID from the consumer perspective, then follow up with an in depth survey and analysis of student perceptions. Using various statistical methods, we demonstrate that consumers' perception of privacy risk likelihood and privacy risk harm negatively impact their intentions to use this technology. The implications of these findings need to be considered before the pending implementation of residual RFID technologies in the supply chain on a mass scale.

## **Methodology**

The research methodology was conducted using a survey instrument, based on previously validated scales where possible, that assessed the perceptions and usage intentions of individuals toward organizations and products that develop and/or employ residual RFID technology. While there has been some popular press about residual RFID technologies, such as the report by Abramson [1] on National Public Radio (NPR), the implications of residual RFID technologies may not have fully entered the consciousness of the average consumer. Since mass adoption of these technologies is imminent, it is important to understand how consumers do and will react to mass residual RFID adoption. Therefore, a brief education piece instructing subjects regarding the fundamental principles of residual RFID technology was presented to each subject prior to completing the survey.

In the interest of research accuracy and applicability, we selected questions for the survey instrument from previously validated instruments where possible, adapting them to meet the criteria of our survey. In addition, we conducted two separate pilot studies in an effort to further validate and refine the selected questions before conducting the final survey and compiling the results.

**Note:** Results will be presented at the conference.

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