Consumer Attitudes toward RFID Usage

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INTRODUCTION

The term RFID refers to *radio frequency identification* and describes transponders or tags that are attached to animate or inanimate objects and are automatically read by a network infrastructure or networked reading devices. Current solutions such as optical character recognition (OCR), bar codes, or smart card systems require manual data entry, scanning, or readout along the supply chain. These procedures are costly, time-consuming, and inaccurate. RFID systems are seen as a potential solution to these constraints, by allowing non-line-of-sight reception of the coded data. Identification codes are stored on a tag that consists of a microchip and an attached antenna. Once the tag is within the reception area of a reader, the information is transmitted. A connected database is then able to decode the identification code and identify the object. Such network infrastructures should be able to capture, store, and deliver large amounts of data robustly and efficiently (Scharfeld, 2001).

The applications of RFID in use today can be sorted into two groups of products:

- The first group of products uses the RFID technology as a central feature. Examples are security and access control, vehicle immobilization systems, and highway toll passes (Inaba & Schuster, 2005). Future applications include rechargeable public transport tickets, implants holding critical medical data, or dog tags (Böhmer, Brück, & Rees, 2005).
- The second group of products consists of those goods merely tagged with an RFID label instead of a bar code. Here, the tag simply substitutes the bar code as a carrier of product information for identification purposes. This seems sensible, as RFID tags display a number of characteristics that allow for faster, easier, more reliable, and superior identification.

Once consumers are able to buy RFID tagged products, their attitude toward such tags is of central importance. Consumer acceptance of RFID tags may have severe consequences for all companies tagging their products with RFID.

BACKGROUND

While consumers constitute the final stage in all supply chains, their attitude toward RFID has hardly been considered. Previous studies have mainly dealt with RFID as an innovation to enhance the supply chain and the resulting costs and benefits for companies along the value chain, that is, suppliers, manufacturers, retailers, and third-party logistics (3PLs) providers (Metro Group, 2004; Strassner, Plenge, & Stroh, 2005).

Until now, few studies have explicitly considered the consumer's point-of-view (Capgemini, 2004, 2005; Günther & Spiekermann, 2005; Juban & Wyld, 2004), and some studies merely present descriptive statistics (Capgemini, 2004, 2005). The remaining few analyzed very specific aspects such as consumer fears concerning data protection and security (Günther & Spiekermann, 2005). Nevertheless, initial results indicate a strong need to educate consumers about RFID. Although consumers seem to know little about this new technology, pronounced expectations and fears already exist in their minds (Günther & Spiekermann, 2005). Therefore, future usage of RFID in or on consumer goods will be strongly influenced by their general acceptance of, and attitude toward, RFID.

To the authors' knowledge, no study so far has explained the influences of RFID usage on consumer behavior based on methods in psychology. The suc-

cess of RFID applications will depend significantly on whether RFID tags are accepted by consumers (Günther & Spiekermann, 2005). In all supply chains, consumers are the very last stage as they buy the final product. In the future, this product might be labeled with RFID tags instead of bar codes. The radio technology can produce a net benefit only if end-consumers accept it. However, a new technology such as RFID may be perceived as potentially harmful by posing a threat to privacy (Spiekermann & Ziekow, 2006). Thus, the consumer point-of-view needs to be considered at an early stage of introduction. It is therefore necessary to uncover the consumer attitudes toward this technological innovation and its application in retailing.

The problem definition is hence specified as follows:

1. How are consumer attitudes concerning the RFID technology and its application to products characterized?
   a. In the first step, attitude needs to be defined and specified for RFID.
   b. The nature of the consumer attitudes toward RFID needs to be determined, described, and also quantified.
2. Relevant implications for enterprises using or planning to use RFID tags will be explained and discussed.

ATTITUDE DEFINITION

The fundamental theory for studying the influences of RFID is based on the model of consumer behavior. The starting point is the relationship between stimulus, organism, and response (SOR) (Kotler, 2003; Kroeber-Riel & Weinberg, 2003). The relevant variables in an SOR model are first of all the stimulus variables (S). As our analysis focuses on the impact of RFID technology, this technology is the stimulus that has an effect on consumers. It causes an observable behavior, which is the reaction or response (R). After the stimulus reception, internal, psychic processes take place in the organism, commonly known as intervening variables (O), causing the observable response. This study investigates the effect of RFID technology on the internal variable attitude.

A person's attitude is a relatively permanent and long-term willingness to react in a consistent cogni-

tive, affective, and conative way (Balderjahn, 1995). Therefore, attitude consists of three components: affect, cognition, and behavior (Solomon, Marshall, & Stuart, 2004; Wilkie, 1994). The affective component reflects feelings regarding the attitude object and refers to the overall emotional response of a person toward the stimulus. The cognitive component subsumes a person's knowledge or beliefs about the attitude object and its important characteristics. The conative component comprises the consumer's intentions to do something; it reflects behavioral tendencies toward the attitude object.

However, Trommsdorff (2004) emphasizes that a direct relationship between attitude and behavior cannot be generalized. Instead, attitude is determined by the affective and cognitive components only. Attitude then directly influences behavioral intentions and indirectly influences behavior. With time, actual behavior retroacts on attitude (Trommsdorff, 2004). Hence, attitude is defined as a construct composed of an affective and a cognitive component. The conative component describes behavioral intentions and is used as an indicator for future behavior.

With respect to RFID, the nature of consumer attitudes should be differentiated into:

- Attitude toward RFID technology (A_{RFID}) in general, and
- Attitude toward products labeled with RFID tags (A_p).

EMPIRICAL STUDY

To determine and quantify consumer attitudes toward RFID, a Web-based study was conducted in June 2005. All in all, 374 respondents from all ages, incomes, and educational backgrounds participated. A Kolmogorov-Smirnov-test tested the variables gender, education, age, and residential location for their distribution. The null hypothesis, that the variables follow a normal distribution, cannot be accepted (p=0.000). This was expected, however, since mostly students were surveyed as Figure 1 also indicates.

To measure the attitude toward RFID technology and toward products with RFID tags (A_p), the questionnaire was based on previous validated studies that dealt with user acceptance of information technology (Davis, Bagozzi, & Warshaw, 1989; Fishbein & Ajzen,

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