

February 2007

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Recommended Citation

Krasnova, Hanna; Rothensee, Matthias; and Spiekermann, Sarah, "Perceived Usefulness of RFID-enabled Information Services - A Systematic Approach" (2007). *Wirtschaftsinformatik Proceedings 2007*. 8.
<http://aisel.aisnet.org/wi2007/8>

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In: Oberweis, Andreas, u.a. (Hg.) 2007. *eOrganisation: Service-, Prozess-, Market-Engineering*; 8. Internationale Tagung Wirtschaftsinformatik 2007. Karlsruhe: Universitätsverlag Karlsruhe

ISBN: 978-3-86644-094-4 (Band 1)

ISBN: 978-3-86644-095-1 (Band 2)

ISBN: 978-3-86644-093-7 (set)

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Perceived Usefulness of RFID-enabled Information Services – A Systematic Approach

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Abstract

Even though RFID technology is currently gaining importance mainly in logistics, usage areas, such as shopping or after-sales enhancements beyond the supply chain are envisioned. Yet, while RFID hits the street it is questioned if it may undermine one's privacy while providing few customer benefits. Meeting this criticism this paper investigates RFID-enabled information services and the drivers of their usefulness for consumers. The article claims that the more risk one associates with a product the more benefit from RFID-enabled information services is perceived. We show empirically that the nature of product risk provides a useful framework to decide on the types of RFID information services a marketer should offer to create RFID usefulness perceptions and increase technology acceptance.

1 Introduction

RFID (Radio Frequency Identification) is becoming an important factor in logistic chains. Wireless object-to-object identification without a line of sight, which promotes increased transparency in supply chains, is often mentioned as its main benefit. However, the uses of RFID are not only limited to industrial applications. In fact, industry would be happy to see RFID chips go beyond the supply chain and create additional end-user markets. Slowly, retail leaders and brands are making first moves in this direction. METRO Group, for example, has opened an

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Innovation Centre in Neuss (Germany) where myriad after-sales and shop floor solutions are displayed, many of which were first introduced to the public at the CeBIT tradeshow in 2006.

However, many consumers seem to believe that RFID chips have the potential to invade their privacy; they fear to lose control and therefore threaten to reject the technology [GüSp04, 245]. For this reason Benetton's attempt to introduce RFID on clothing was despised and hastily cancelled [Albr03]. On the other hand, some RFID applications already introduced to the market seem to be very welcomed and have never been subject to any privacy critique. These include ski-passes, entry tickets to major events and public transportation, tags used in sports clubs, during marathon events or in public libraries. This contradiction in public feelings has been one of the main impetuses for this study. The main goal of this paper is to determine which RFID-enabled services consumers find useful and whether there are factors systematically influencing usefulness perceptions. To achieve this goal we focus on RFID-enabled information services in contrast to tracking and access services. Information is relevant for consumers prior to purchase, because it allows for reducing purchase uncertainties. RFID allows for the provision of richer information than what is available on packaging surfaces (or using a bar code) as well as qualified recommendations. Therefore, RFID may be used as an important lever for consumers in order to make purchase decisions in a more informed way. The question arises, however, where in particular consumers will appreciate RFID for this purpose.

The present article is structured as follows: first, we summarize product risk theory and then relate this to RFID-enabled information services. Using this theoretical basis, we then present an empirical study we conducted to investigate where RFID-enabled information services can potentially be interesting for consumers. We analyze whether perceived product risk can systematically explain differences in consumers' perceived usefulness of RFID. We also add citations throughout the text from a number of focus groups we conducted on the subject at the Humboldt University in winter 2006. A detailed discussion of the obtained results, conclusions for the industry and study limitations are provided at the end of the paper.

2 Theoretical Background

2.1 Product Risk and Information Search

Marketing theory has accumulated a large number of models regarding the way consumers make product choices and factors which are important for their purchase decisions [Chis94, 193]. One of the most popular models, first developed by [Cunn67], [Baue60] and [CoxD67], suggests that perceived risk attributed to products influences the way consumers make their product choices and seek product information prior to purchase. [Cunn67, 84] suggests that perceived product risk can be measured using a multiplicative relation of two elements: uncertainty associated with a product purchase (measured as the probability of loss) and consequences (measured as the importance of the respective loss). In turn, [MuEn86, 31; based on JaKa72] consider five product risk dimensions:

- „Financial risk – the risk that the product will not be worth the financial price;
- Psychological risk – the risk that a poor product choice will harm a consumer’s ego;
- Physical risk – the risk to the buyer’s or other’s safety in using products“;
- Functional risk – the risk that the product will not perform as expected;
- Social risk – the risk that a product choice may result in embarrassment before one’s friends/ family/ work group“.

The main inference from the perceived risk model is that consumers will try to minimize their purchase risks before they buy something and systematically seek for information that reduces purchase uncertainty [Kosc97, 1658]. Therefore, most of the literature on consumer behavior [KASW03, 325; AnRa98, 256; ScKa97, 189] highlights information search about a product as a risk-reducing strategy.

Information search and availability is also the focus of another well-known product classification suggested by [DaKa73; Nels70] and then further developed by [WeAd95a; WeAd95b]. This classification categorizes products according to the amount of information available to the consumer prior to purchase. It distinguishes between search, experience and credence goods:

- Search goods are goods with dominant search qualities, „which can be fully evaluated by the consumer through product inspection or information collection be-

fore purchase“. Examples include clothing, cell phones, music CDs, apparel, furniture, shoes, memory stick;

- Experience goods are goods with dominant experience qualities, „which can be evaluated by the consumer only after purchase“. Examples include boxed products, medicines, garments, personal items, wine, liquor, food, watch;
- Credence goods are goods with dominant credence qualities, „which can be fully evaluated by the consumer neither before nor after the purchase“ [WeAd95b, 54, translated by the author]. Examples include “vitamins”, bio-labeled food, “water purifier” [GiSK02].

This classification makes plain that uncertainties related to a product may reach beyond the immediate sales situation and into after-sales scenarios where consumers use and experience the product they bought. Here, equally, RFID-enabled information services may play a role.

2.2 RFID Information Services and the Role of Product Risk

Generally, three groups of RFID-enabled consumer services can be distinguished: information services, tracking services and access services. For reasons of complexity reduction the present paper concentrates exclusively on *RFID-enabled information services* which can in turn be subdivided into *information on authenticity, recommendations, warranty information and additional information*.

Ensuring product *authenticity* is vital for many products. In order to „combat counterfeiting“ [Pfiz06] has started tagging its Viagra products in the USA in 2006. Now a consumer can check the authenticity of Viagra pills directly in the pharmacy or using a smart medicine cabinet at home to make sure his health will not be damaged by a fake product, thus reducing physical/health risks. As one participant in a focus group noticed: „*If there is a possibility to make them (medications) safer then I find it good*“. In shopping environments one can check the authenticity of packaged meat or medication using e-info-points by simply placing a product close to an info-reader. Repair shops for expensive goods (musical instruments, watches) can also be supplied with authenticity check devices in order to ensure that a product is not claimed stolen. A portable home reader can ensure the original taste of a French wine ordered online. Financial and functional risks for future owners could thus be reduced.

Recommendations on compatibility or suitability can be provided in various sales contexts as well as after-sales settings. Smart medicine cabinets, smart change closets and mirrors or smart fridges are examples. These applications are supplied with readers registering RFID-tagged products, e.g. medications, clothing or food placed into them. They then „recommend“ buying well fitting clothes, removing expired medicines, etc. Thus, by following electronic wardrobe recommendations one may be able to diminish social risk by ensuring that a selected jacket suits to formal office style and current fashion.

RFID-enabled *warranty* includes expiration dates or information relevant for subsequent repair, resale or recall. For example, RFID-enabled warranty for a laptop ensures that there will be no bad surprises if a customer accidentally loses the receipt, thus reducing financial risk. Equally, RFID pro-actively informs that clothes may be returned to the store until a certain date. Consumers may, as a result, feel a relief in social and psychological purchase risks.

Finally, RFID can provide *additional information* on products. The ability to easily access electronic manuals and set-up support as well as upgrades on the Internet might reduce the functional risk of a complex technical product (such as an espresso machine or a copy machine) by ensuring that the right sequence of actions will be undertaken. Naturally, users will be more likely to use such RFID-enabled features as they do not require any effort from their side as opposed to the bar code, where a line of site is important.

All in all, by using RFID-enabled information services a consumer can alleviate certain risks attributed to a product. On this basis we now narrow down and explore *how* consumers evaluate the usefulness of RFID-enabled information and if perceived risks associated with a product can have an effect on the perceived usefulness of RFID-enabled information services.

3 Method

3.1 Procedure

An online questionnaire was passed to 149 study participants in order to collect empirical results on the relation of risk and perceived RFID usefulness. The recruiting of the study subjects was done as a convenience sample by sending an invitation to a university mailing list. Each participant was rewarded EUR 10 for a completed survey. The questionnaire was accessible online from March 11th 2006 until April 2nd 2006.

Out of the 149 participants 63% (93) were female and 37% (55) were male. Most of the participants were young people (73% were in the age of 20-29 years) and had either a university (35%) or a high school degree (59%). They were also familiar with technology since 129 (88%) were preparing half or more of their work with computers.

3.2 Products Tested and Questionnaire Structure

In order to test the relationship between perceived product risk and usefulness of RFID the questionnaire always related to a constant selection of nine products. These products were chosen with a view to the classification into search, experience and credence goods [WeAd95a; WeAd95b]. Equally, the products were expected to display different levels of product risk. Table 1 gives an overview of the chosen products.

Classification category	Selected products
Search goods	Alarm clock, digital camera, gloves
Experience goods	Anti-dandruff shampoo, espresso machine, migraine pills
Credence goods	Bio-meat, vitamins, diamond

Table 1: Selected products for each category

The questionnaire consisted of three question blocks. In the first block we checked if the participants would categorize the products as theoretically expected. The participants had to rate three statements on a 5-point Likert scale from very improbable (1) to very probable (5): The first question tested the search qualities attributed to products: *„Before purchasing product X I can fully judge on important quality characteristics“*. The second question aimed to test the experience qualities of the products *„After purchasing and using product X I can fully judge on quality characteristics important for me“*. The third negative question tested the credence qualities of the products: *„Even after purchasing product X I cannot fully judge on quality characteristics important for me“*.

The second part of the questionnaire was dedicated to the identification of the levels of perceived risk associated with the selected products. The evaluation was done in two steps. First the participants were asked to put themselves in the position of a potential buyer and from this perspective to rate the probability of financial, functional, psychological, social or physical damages (*„How probable is it that the purchase of the product X will have negative financial consequences for you?“*) from very improbable (1) to very probable (5). At the second step they

had to assess the amount of the resulting damage for them („*How high do you estimate financial loss... ?*“) from very low (1) to very high (5).

The third part of the questionnaire dealt with measuring the level of perceived usefulness of four RFID-enabled information services (authenticity, recommendations, warranty/expiration dates and additional information) for the selected products both before and after purchase. The participants were asked to rate the usefulness of these information services from not useful (1) to very useful (5) for each product first before purchase and then after purchase. The questions were stated in the following way: first a specific RFID-enabled information service was presented to the participants (e.g. „*imagine you could electronically get additional recommendations for a product, i.e. recipes for food, right on the shopping floor*“), then the way how to access this service was described (e.g. „*you simply hold a product to your shopping cart and read information on the screen*“) and finally the participants were asked „*how useful*“ they would find this RFID-enabled information service.

Even though the participants were asked about the usefulness of each information service both before and after purchase, only the results on before purchase evaluations will be considered here for the sake of brevity.

4 Results

4.1 Product Classification in Terms of Perceived Risk

Assessment of the perceived risk profiles for the selected products was carried out using the multiplicative relation described above, thus the least risky product would get the value of 1 and the most risky one the value of 25. Table 2 summarizes the obtained results averaged across all the participants. The values of the three most risky products in each individual risk category are selected in bold.

Averaged risk levels indicate that financial and functional risks were the most dominant ones across all products. These risks were evaluated as especially high for such complex technical goods as an espresso-machine or a digital camera and a diamond. Overall, these goods illustrate the same perceived risk profile: the highest three levels of financial, functional, psychological and social risks and very low levels of the physical/health risk. On the basis of their risk profile we will generally call this group of products „complex“ goods. Such products as vitamins, bio-

meat and migraine pills excelled in the highest physical/health risk. For this reason we will refer to them as „high physical/health risk“ products. Alarm clock, anti-dandruff shampoo and gloves were perceived as relatively risk free products and can be labeled as „simple“ goods. Overall, the *social risk* played only a marginal role.

Products	Financial Risk	Function. Risk	Psycho-logical Risk	Physical Risk	Social Risk	OPR* _j
Diamond	17,3	11,3	12,0	3,2	8,5	52,3
Espresso machine	14,8	13,2	11,0	6,0	7,1	52,1
Digital camera	13,8	11,7	12,1	3,3	6,6	47,5
Vitamins	6,6	9,0	6,8	13,3	4,3	40,0
Bio-meat	5,6	7,2	5,0	12,0	4,8	34,6
Migraine pills	5,0	7,8	5,1	14,7	4,0	36,6
Alarm clock	4,3	6,5	5,0	3,3	3,3	22,4
Anti-D. shampoo	4,0	6,8	5,8	8,6	3,9	29,1
Gloves	4,0	4,8	5,4	4,0	4,1	22,2
Averaged risk levels						
	8,4	8,7	7,6	7,6	5,2	

Table 2: Summary of perceived risk level results for the selected products
 *OPR_j - overall perceived risk for product j is calculated as a sum of five individual risk values attributed to product j.

Finally, throughout all risk types (except for the psychological risk) we have got the same ranking order with respect to the perceived risk level for the three products that best represent the respective product categories: vitamins as a typical credence good are always followed by anti-dandruff shampoo as a typical experience good, which is always followed by gloves as a typical search good. Seen that the three products can be purchased at comparable prices this risk correspondence to the product classification is interesting and helpful for subsequent generalizations. In Table 3 we have averaged all risk values for all products in a respective classification category. As one can see there is – beyond individual products - a general tendency for the highest risk to be attributed to credence goods, followed by experience goods and then search goods.

Product categories	Products in the category	Averaged level of risk for a product category	SD*
Search goods	Alarm clock, dig. camera, gloves	6.1	2.0
Experience goods	Espresso machine, migraine pills, anti-dandruff shampoo	7.8	2.4
Credence goods	Bio-meat, vitamins, diamond	8.4	2.5

Table 3: Summary of risk level results averaged over product categories
 *SD =standard deviation

4.2 Perceived Usefulness of RFID-enabled Information Services

At this stage of the questionnaire the participants were asked to rate the usefulness of four RFID-enabled information services. Averaged results for each product and each RFID-enabled information service before purchase are presented in Table 4. Here, the top three perceived usefulness values for the products are selected in bold for each individual information service.

As follows from Table 4, *authenticity* was mainly perceived as the most useful information service out of the four RFID-enabled information types and this is true for almost all products before purchase.

Products	Authenticity	Recommendation	Additional Information	Warranty Expiration Dates	Sum of usefulness values	The most useful RFID-enabled information service
Dig. camera	4,3	3,7	3,9	4,2	16,0	authenticity
E-machine	3,9	3,3	3,7	4,2	15,1	warranty
Migr. pills	4,0	3,5	3,4	3,4	14,3	authenticity
Vitamins	4,0	3,4	3,3	3,3	14,1	authenticity
Bio-meat	4,3	3,3	2,6	3,6	13,8	authenticity
Alarm clock	3,0	2,4	2,9	3,5	11,8	warranty
Shampoo	3,4	3,1	2,7	2,7	11,8	authenticity
Diamond	3,9	2,5	2,1	2,9	11,5	authenticity
Gloves	2,8	2,3	2,0	2,7	9,7	authenticity
Averaged usefulness levels						
	3,7 (quite useful)	3,1 (fairly useful)	3,0 (fairly useful)	3,4 (fairly/quite useful)		authenticity

Table 4: Perceived usefulness of RFID-enabled information services for the products before purchase

The participants rated authenticity higher than 3,0 on a scale from 1 to 5 for most of the products. Foremost, the participants were interested in the authenticity information for high physical/health risk products such as bio-meat, migraine pills and vitamins. Authenticity information was also important for complex goods, such as digital cameras, espresso machines or diamonds. The participants equally rated the usefulness of *warranty and expiration dates* higher than 4,0 for complex technical products and higher than 3,3 for high physical/health risk products. Some value was attributed to RFID-enabled *recommendations*, with the answers fluctuating around the level of 3,0 with complex technical goods and medications having been placed at the top of the perceived usefulness of recommendations list. However, for technical products, such as digital cameras, espresso machines or alarm clock recommendations were the least useful RFID-enabled information service of all four. For products from a personal use domain, such as

anti-dandruff shampoo, migraine pills and vitamins, it was the second most important information. *Additional information* was not popular among the participants with the attributed usefulness values surpassing the level of 3,0 only for complex technical goods and medications. For such products as bio-meat, migraine pills, diamond and gloves it was the least useful information service of all four.

Column six in Table 4 shows summed averaged perceived usefulness values of the four information services for every product sorted in a descending order. As one can see, RFID-enabled information services are valued highest when it comes to complex technical goods (here digital camera and espresso machine). The second highest valuation of the information is attributed to products high on physical/health risks (here migraine pills, vitamins and bio-meat).

4.3 Multiple Regression Analysis

Sections 4.1 and 4.2 have prepared the ground for investigating in a next step whether perceived risks associated with a product can systematically affect perceived usefulness of RFID-enabled information services. This effect can be evaluated by looking at the multiple regression coefficients (b_{ijt}) resulting from a multiple regression analysis, where perceived usefulness of an RFID-enabled information service (U_{jt}) for a product is a dependent variable and the five perceived risks (R_{ij}) associated with the product in question are independent variables. Equation (1) summarizes this relationship.

$$U_{jt} = \sum_{i=1}^n b_{ijt} R_{ij} \quad (1)$$

where

U_{jt} - perceived usefulness of RFID-enabled information service t of product j before purchase;

R_{ij} - perceived risk of dimension i attributed to product j ;

b_{ijt} - regression weight of risk dimension i attributed to product j on the perceived usefulness of RFID-enabled information service t ;

n - risk dimensions.

Since we collected measurement points from nine products and four RFID-enabled information services, our analysis involved 36 regression models. As expected not all of them resulted in a high level of explained variance since product risk can only be *one* variable driving usefulness perceptions. However, we did find that regression equations on vitamins, migraine pills and

anti-dandruff shampoo have relatively high levels of R^2 with these models explaining 10-17% of the usefulness variance of RFID-enabled information services. Furthermore, risk had a slightly higher explanatory value for the usefulness of RFID-enabled recommendations before purchase than after purchase. This makes sense since risk-reducing recommendations before purchase are more valuable to consumers than when the products have already been bought. This difference is however statistically non significant.

Looking into the detail of regression functions 30% of b_{ijt} -coefficients in the regression equations were significant. However, this percentage number is relatively less important than an understanding *where* beta coefficients were indeed significant. Here an interesting pattern arises. First, functional risk seems to be the main driver of RFID usefulness perceptions. 41% of all significant b_{ijt} -coefficients refer to functional risk. The next highest scoring risk dimension is physical risk. 26% of significant b_{ijt} -coefficients fall into this category. In comparison, social (17%) and financial (13%) risks seem negligible. And psychological risk adds no explanatory value at all. Short: RFID-enabled information services are valued across all products in order to reduce functional risk. Physical risk also plays a role, even though few products imply such a risk. Once a product does imply physical risk from a consumer's perspective almost any RFID-enabled information type is welcomed. Finally, social risk has an impact on RFID usefulness perception. It seems to be important when it comes to recommendations about a product or checking for warranty information. Table 5 gives an aggregated view to support this analysis by providing the average of b_{ijt} -coefficients (\bar{b}_{it}) over the nine products for RFID-enabled information service t and risk dimension i before purchase. The values of \bar{b}_{it} higher or equal to 0,1 are selected in bold. This aggregated view shows that warranty information takes a lead among the various available information types, closely followed by information on authenticity.

Information service	Financial risk		Functional risk		Psychological risk		Social risk		Physical risk	
	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD
Authenticity	0,05	0,13	0,18	0,09	-0,01	0,07	0,01	0,11	0,11	0,06
Recommendation	0,02	0,18	0,08	0,07	-0,01	0,10	0,11	0,06	0,06	0,12
Additional info.	0,15	0,10	0,05	0,08	-0,04	0,10	0,05	0,10	0,13	0,13
Warranty	0,04	0,12	0,10	0,09	+0,04	0,07	0,10	0,07	0,11	0,10

Table 5: Regression coefficients (\bar{b}_{it}) and standard deviations for RFID-enabled information services and risk dimensions, averaged over all products

5 Discussion

The data collected give us some interesting insights into the areas where RFID-enabled information services are useful from a consumer perspective. Three angles can be used to discuss the findings: the type of product, associated product risk as well as the type of information provided by RFID.

The analysis of product perceptions and averaged service usefulness has shown first that complex technical goods imply the highest usefulness for RFID-enabled information. This group of products is closely followed by sensitive products in the physical/health domain. For simple products RFID-enabled information services, in contrast, seem to be perceived as little useful by the majority of the study participants. Another angle to grasp this finding is to argue that there may be a slight tendency for preferring RFID-enabled information if experience or credence goods are concerned (in contrast to search goods).

The study of perceived usefulness of various RFID-enabled information services has also revealed that the participants were interested most in information on authenticity and warranty. Authenticity seems to be particularly important for health/physical risk products. The focus groups have shown that in case of high physical/health risk goods the participants equated product authenticity with safety. In this vein one focus group participant stressed that *„(fake medicines) have disastrous consequences for consumers“*. *Warranty/expiration information* was especially important for complex technical goods: *„...one can check on the personal computer if the promises of the producer are really true“*.

Finally, the analysis of risk dimensions and their explanatory value for the appreciation of RFID has shown that functional and physical risks are the most important drivers of information needs. This is a valuable insight, because marketers may want to start enhancing their information activities with the help of RFID for products in this particular area. An example could be to offer interactive manuals and clips that could be downloaded from the chip or accessed with the help of the chip's product code. Equally, safety related issues, such as the potential of food to trigger allergies, or the sources of meat and milk products may be appreciated by consumers. In contrast, RFID-enabled information was less appreciated to relieve psychological risk, even though RFID could be used to trigger quite a few services addressing the coolness and suitability of products. First prototypical implementations of RFID-enabled information services for consumers also focus in this area, such as the intelligent change closet offered by GERRY WEBER. Both accessibility and „habitude“ may offer an explanation for why the relief of psy-

chological risks through RFID may be less appreciated than the relief of functional or physical risks. Marketers already today put a great effort into reducing functional risk when offering manuals and how-to-use information. Equally, they provide information on ingredients or safety notices so that physical or health risks are addressed. Social risk is typically reduced today by interacting with store personnel. On the other hand, psychological risk is alleviated by internal mechanisms such as self-reflection and self-confidence. Thus, it is reasonable to expect that psychological risk will be most resistant to change by an external device or service, because the device or service cannot directly access these mechanisms. As one participant in the focus group put it: *„I don't know whether I need a smart wardrobe that makes suggestions to me, which I don't want at all. It goes too far for me. I see no sense in this. I have my own taste“*. Furthermore, the usefulness of RFID-enabled information displays is new and may not be appreciated as much due to its unfamiliarity to the user. It is what Donald Norman refers to as a „disruptive technology“ [Norm98, 231-247] and it lacks compatibility to traditional norms [Roge03], both arguments standing in the way of a rapid dissemination of a technology. This argument has consequences for the current work in so far as it emphasizes that the appreciation of RFID-enabled information in different risk contexts may be apt to change over time. Also, it cannot be excluded that it is differing between cultures. Therefore the study results should be considered applicable at the current point only to the German market as a relatively uneducated market as far as RFID is concerned.

However, in the current situation industry needs a way to systematically prioritize the introduction of RFID on products and it needs to know what to focus on when introducing RFID-enabled information services. For this purpose Table 6 provides some good guidance, summarizing the findings reported on in this article.

Risk dimensions	Potential risk relievers provided by RFID-enabled information services		
Financial risk	Additional info.		
Functional risk	Authenticity	Warranty	
Psychological risk			
Social risk	Recommendations	Warranty	
Physical risk	Authenticity	Additional info.	Warranty

Table 6: Perceived risks and their potential relievers for customers

6 Conclusion and Limitations

This article has shown how product risk can be used to provide for a systematic approach in offering RFID-enabled information services to a final consumer and thus drive usefulness perceptions and acceptance. The insights allow for some valuable recommendations for the industry. In their marketing agenda, companies should first of all emphasize the possibility to check warranty/expiration dates especially for complex technical and high physical/health risk products, such as electronics, medications or food. The possibility to access authenticity information should also be put in the forefront of advertising campaigns for high physical/health risk products, especially those susceptible to counterfeiting. Identification of the risk perceptions associated with a given product may generally be considered a strategy for companies to determine in which directions the technology should be advertised.

Yet, despite these interesting results, there are also some limitations to this research. First of all because recruiting of the participants for the questionnaire was done as a convenience sample, the sample is not representative. The study also involved a limited selection of nine products which does not allow for a broad generalization. Because of hypothetical nature of many survey questions, it could have been difficult for some participants to realistically assess part of the proposed situations. Furthermore, only for a small part of models the R^2 exceeded 10% of explained variance. Also, previous studies have shown that information search (shopping) is not always the most preferred method for consumers to reduce their risk [Rose67, 58]. Instead, product brand, specialized retailers and personal traits could be often more influential for product choice. Understanding this relative importance of future RFID-enabled information services in comparison other marketing activities is an interesting area of future research.

Bibliography

- [Albr03] Albrecht, Katherine: Press Release.
http://www.boycottbenetton.com/PR_030407.html, 2003-04-09, download on 2006-04-10.
- [AnRa98] Antonides, Gerrit; van Raaij, W. Fred: Consumer Behaviour. A European Perspective. John Wiley and Sons Ltd, Chichester 1998.

- [Baue60] Bauer, Raymond: Consumer Behavior as Risk Taking. In: Hancock, R. S. (ed.): Dynamic Marketing for a Changing World, Proceedings of the 43rd Conference of the American Marketing Association 1960, p. 389- 398.
- [Chis94] Chisnall, Peter M.: Consumer Behaviour. 3rd rev. ed., McGraw-Hill, London 1994.
- [CoxD67] Cox, Donald: Risk Taking and Information Handling in Consumer Behavior. In: D.Cox (eds.): Risk Taking and Information Handling in Consumer Behavior. Harvard University Press, Boston 1967, p. 604-639.
- [Cunn67] Cunningham, Scott M.: The Major Dimensions of Perceived Risk. In: Cox, D. (eds.): Risk Taking and Information Handling in Consumer Behavior. Harvard University Press, Boston 1967, p. 82-108.
- [DaKa73] Darby, Michael R.; Karni, Edi: Free competition and the optimal amount of fraud. In: Journal of Law and Economics 16 (1973), p. 67-86.
- [GiSK02] Girard, Tulay; Silverblatt, Ronnie; Korgaonkar, Pradeep: Influence of Product Class on Preference for Shopping on the Internet. In: Journal of Computer-Mediated Communication 8 (2002) 1, <http://jcmc.indiana.edu/vol8/issue1/girard.html>, download on 2006-04-10.
- [GüSp04] Günther, Oliver; Spiekermann, Sarah: RFID vs. Privatsphäre ein Widerspruch? In: Wirtschaftsinformatik 46 (2004) 4, p. 245-246.
- [JaKa72] Jacoby, Jacob; Kaplan, Leon B.: The Components of Perceived Risk. In Venkatesan, M. (ed.): Proceedings, Third annual conference of the Association of Consumer Research. Association for Consumer Research, Ann Arbor, MI 1972, <http://www.acrwebsite.org/volumes/display.asp?id=12016>, download on 2006-04-10.
- [Kosc97] Koschnick, Wolfgang J.: Lexikon Marketing M-Z. 2nd rev. ed., Schäffer-Poeschel, Stuttgart 1997.

- [KASW03] Kotler, Philip; Armstrong, Gary; Saunders, John; Wong, Veronica: Grundlagen des Marketing. 3rd ed., Pearson Education Deutschland, München 2003.
- [MuEn86] Murphy, Patrick E.; Enis, Ben M.: Classifying Products Strategically. In: Journal of Marketing 50 (1986), p. 24-42.
- [Nels70] Nelson, Phillip: Information and consumer behavior. In: Journal of Political Economy 78 (1970) 2, p. 311-329.
- [Norm98] Norman, Donald A.: The invisible computer. MIT Press, Cambridge 1998.
- [Pfiz06] Pfizer: Pfizer Introduces Radio Frequency Identification Technology to Combat Counterfeiting, Protect Patient Health.
http://www.pfizer.com/pfizer/are/investors_releases/2006pr/mn_2006_0106.jsp,
 2006-01-06, download on 2006-04-10.
- [Roge03] Rogers, Everett M.: Diffusion of innovations. 5. ed., Free Press, New York 2003.
- [Rose67] Roselius, Ted: Consumer Ranking of Risk Reduction Methods. In: Journal of Marketing 35 (1967), p. 56-61.
- [ScKa97] Schiffman, Leon G.; Kanuk, Leslie L.: Consumer Behavior. 6th ed., Prentice-Hall, Englewood Cliffs 1997.
- [WeAd95a] Weiber, Rolf; Adler, Jost: Ein Einsatz von Unsicherheitsreduktionsstrategien im Kaufprozeß: Eine informationsökonomische Analyse. In: Zeitschrift für betriebswirtschaftliche Forschung, Sonderheft 35 (1995), p. 61-77.
- [WeAd95b] Weiber, Rolf; Adler, Jost: Informationsökonomisch begründete Typologisierung von Kaufprozessen. In: Zeitschrift für betriebswirtschaftliche Forschung 47 (1995), p. 43-65.