

## **BENEFITS AND RISKS OF RFID TECHNOLOGY IN RETAIL FROM THE YOUNGER CONSUMERS' POINT OF VIEW**

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*Scientific paper*

### ***Abstract***

Radio frequency identification technology (RFID technology) is one of the rapidly growing technologies with a huge potential of application in retail supply chain. Numerous research papers claim that RFID technology can have enormous positive impact on business processes in supply chains: (1) due to the real time items tracking, they have a positive impact on inventory management, (2) “smart labels” improve automatic identification in warehouses and outlets and brings the idea of “smart shelf” into the practice, (3) shelf stocking and in-store product replenishment is becoming more efficient, (4) business forecasting in the field of inventories and stocks is applying the real-time quantities, (5) there are numerous advantages in the check-out procedures starting from the reduction of consumers’ time and effort spent at the cashier desk throughout the increased productivity of employees within the store (6) it reduces overhead costs by improving shipping and receiving procedures and by eliminating the human error out of supply chain administration activities.

Nonetheless, the introduction of RFID technology into every-day retail activities rises up numerous issues regarding privacy and ethics of its usage. Firstly, this paper, based on secondary data, gives a critical overview of benefits and risks of RFID technology observed and explained by other authors. Secondly, upon the critical overview, the questionnaire was created and a primary research was done on the sample of younger consumers in Croatia in order to explain how they perceive advantages and disadvantages of introduction of RFID technology in retail and every-day life.

**Key words:** RFID technology, young consumers, retail technology, supply chain

## 1. INTRODUCTION

In today's modern society, where market competition has progressively grown, it is necessary that the company strengthen its competitive capacity which is influenced by various factors such as information, information and communication technology and information systems thereby creating new business intelligence, so-called competitive intelligence (Panian et al., 2007, p. 17-18).

High competition in business operations and ever greater customer demands for information on purchased items require traders to implement new technological trends in their retail sales. Radio frequency identification (RFID technology) is one of the fast growing technologies with a huge impact on speeding up the business processes. RFID is designed as an alternative to linear codes, where products are identified wirelessly by using radio waves. It is anticipated that the application of RFID technology is going to replace business line code in the future. Devi has given the most complete definition of RFID technology, which states: RFID is technology for the conversion of analog to digital, which uses radio frequency waves to transfer data between a moving object and the reader to identify, monitor and to locate the item (Mesarić & Dujak, 2009, p. 116).

During its development, radio frequency identification has been recognized as a technology that has a wide range of applications due to faster information flow, cost reduction and time saving. Today, RFID systems are used in retail, transport, medicine, manufacturing, control of entry into the buildings and logistics, i.e. where faster access to data is needed. The European Central Bank plans to introduce RFID technology for tracking bills to allow law enforcement agencies prevent transactions related to crime (Xiao & Sun, 2006, p. 64). Adoption and the use of RFID technology has increased rapidly, when large scale organizations and retailers, such as Wal-Mart and US Department of Defence, conditioned its suppliers and business partners to use RFID technology in their business. Conditioning business partners, manufacturers and suppliers in the supply chain is one of the most important factors which influenced the introduction of RFID technology in the supply chain management in individual companies (Delač, 2012, p. 11).

However, omnipresent use of RFID technology has brought up a number of privacy related issues. Unlimited possibilities for RFID technology use in applications requiring identification and data listing raise multiple possibilities for RFID technology abuse. Removing the flaws from the use of RFID technology and implementing new and better quality solutions as well as higher standards, should stimulate the business sector to invest more in this technology. Due to the increasing application of RFID technology it is necessary to improve appropriate standards and to take a number of measures to protect data from unauthorized "intrusion". RFID technology is considered one of the ten technologies of the 21st century that contribute to the technological and economic development.

This paper will present the application of RFID technology in retail, its advantages and disadvantages, as well as the impact on the privacy of consumers with

special reference to young consumers' views on privacy issues raised through the use of RFID technology.

## **2. APPLICATION OF RFID TECHNOLOGY IN RETAIL AND ITS IMPACT ON CONSUMER PRIVACY**

Globalization, informatization and internationalization of the industry affected the retail businesses, a change in business strategy and the introduction of new technologies such as bar code and RFID technology, for labeling and sales of products, which enables us to store more data about the product. RFID technology is becoming the key to successful retail which is one of the most dynamic and fastest growing industries. Retailers are most reluctant to deploy RFID technology after the experimental period due to many advantages that this technology offers especially in creating new business value for retailers (Hellström, 2009, p. 1-21). New technologies have a major impact on automation of commodity process, warehousing, procurement of goods and transport (Renko et al., 2009, p. 157).

With the aid of RFID infrastructure used as a tool for operational business intelligence, managers get timely and quality information that are useful to avoid financial losses, improve risk management, fraud reduction and faster decision-making. By using business intelligence, companies may obtain much faster response to market demands and changes taking place, so the company can have a timely list of clients who purchased individual product in a period of time (Panian et al., 2007, p. 100). RFID technology alone does not bring benefits, but in interaction with business processes (Hellström, 2009, p. 1-21).

Strong competition in business and the increasing consumer demand require retailers to have a sufficient quantity of products on the stock in order to meet their needs, to reduce the consumption of human labor and to simplify business operations. Consumers want to make a purchase as quickly as possible - in order to achieve this, application of radio frequency technology in retail is essential which would enable the acceleration of purchase and provide greater awareness of products. Primary activities for retail management, supported by human resources, information technology and procurement are (Dunković et al., 2010, p. 180):

- internal distribution and inventory management: storage, receipt and internal distribution of goods;
- displaying goods: selection of merchandise and assortment that will ensure growing demand, setting prices;
- marketing: promotions, loyalty programs, own credit cards, market reputation;
- operational in store activities: decorating stores and other facilities in order to provide the customer with a better view and purchase experience, techniques and identification of goods on the way out.

The retail commodity processes, which account for a large portion of time spent, are connected with ordering and positioning of goods on the shelves. The stores are introducing central calculation because each commodity group within retail requires a specific approach to ordering and positioning of the product, in order to reduce the

number of erroneous decisions (Fičko, 2009, p. 63). Automatic positioning of goods allows the effective use of storage or retail space and better positioning of attractive products in visible places. In the supply chains following technologies are commonly used:

- information technologies for the collection and rough processing of data (RFID),
- information technologies for data analysis with the aim of making management decisions (database management system, storage, transport and inventory) and
- information technologies for data exchange and integration.

Significant features of RFID technology are the automatic data collection, real-time information and location system in real time, thus ensuring a broad application in the retail and supply chain. In order to successfully implement RFID technology in the supply chain, it is important that everyone benefits, not only by increasing productivity but also in the realization of surplus value for all members of the supply chain (Dujak et al., 2011, p. 265).

Following the request of one of the largest retail chains, Wal-Mart in the United States, to its suppliers that they must label their products RFID tag Ids, comes to the widespread use of RFID technology in other major retail chains. From 2010 to 2013, the share of the purchase value of the goods in net sales of the retail chain Wal-Mart was on average 74.8% (Knego et al., 2013, p. 12). In 2003 Metro opened the store equipped with RFID technology in Europe (Dujak 2006, p. 99). With the wide application of RFID technology the Metro Group company started in 2004 in selected warehouses and stores. To date, 180 Metro Group partners equip pallets and boxes with special transponders.

In order to achieve business objectives, retail stores are faced with the following business requirements (Druzijanic & Druzijanic, 2014, p. 206):

- an increase in sales volume,
- reducing the cost of procurement of goods and services,
- reducing the cost of business process,
- attracting new and retaining existing customers.

Since the beginning of 20th century we are witnessing faster development of logistics, whose role in the gross domestic product (GDP) is becoming important in all national economies. The degree of development of logistics varies in highly developed countries, transition economies and developing countries. Table 1 shows the share of the value of logistics services in GDP in highly developed countries and transition countries. It is evident that the logistics is highly developed in the tertiary sector. In Europe, 10-25% of the total operating costs of enterprises make logistics costs (Renko et al., 2009, p. 159). The company that applied RFID technology in its business has shown the greatest savings in logistics costs, that account between 20-25% of the total cost of the company (Dujak 2006, p. 94).

**Table 1.** Share of the logistics services in GDP in developed and transition countries

Sector	Developed countries (2000.)	Transition countries (2000.)
Primary	25%	< than 10%

Secondary	30%	< than 10%
Tertiary	50%	10 to 20%
Quaternary	30%	10 to 20%
Fifth	30%	< than 15%

Source: Renko, S., Fičko, D. & Petljak, K. (2009). Novi logistički trendovi kao potpora maloprodaji, *Proceedings of 9<sup>th</sup> international scientific conference Business Logistics in Modern Management*, Segetlija, Z., Karić, M. (ed.) Faculty of Economics in Osijek, Osijek, p. 159.

The implementation of the concept of integrated supply chain eliminates unnecessary spending of materials, time and money, thus focusing modern business on generating a higher value for consumers (Knego et al., 2013, p. 14). Since 2010, there have been improvements and upgrades of RFID technology, that may improve inventory tracking in stores and warehouses in the future (Dunković, 2011, p. 54). Reduced confidence of retailers in the profitability of the implementation of RFID technology has increased by replacing disposable tag's with multiple tag IDs for the labeling of food products. Disposable RFID tags were too expensive for implementation in food products.

Disadvantage of RFID tags is that they can not read off products with metal or liquid parts. Retailers see their advantage in using multiple tag's due to reversible logistics to production sites, while the multiple tag's are less favorable to suppliers (Dunković, 2011, p. 55).

The success in the retail business depends on good customer experiences, implementation of new technologies such as RFID, Internet and database management. For this reason, retailers are looking for ways to reduce costs and to improve their offerings through effective supply chain management. The implementation of RFID technology in the retail supply chain reduces the out-of-stock situations and improves management policies, reduces theft, and allows quicker passage through the cash register as well as improved productivity (Devi, 2007, p. 111-113). To meet the increasing demands of the market and to be competitive at European market, retailers in Croatia should turn to new technologies that already exist for many years in foreign markets and that have shown positive effects, such as RFID technology.

Investments in retail information systems in Croatia will contribute to better relations with customers and better business organization. Research related to the implementation of RFID technology suggest following benefits: reducing the cost of doing business due to automation of the processes, a better overview of the products and the increase of operational efficiency. On the other hand, problems related to the implementation of RFID technology are privacy, lack of standardization and the high cost of RFID tag's (Delač et al ., 2013, p. 194).

Table 2 provides a comparative overview of the use of RFID technology in enterprises with at least 10 employees in Europe and Croatia in 2009, 2011 and 2014. The data are downloaded from Eurostat.

**Table 2.** The usage of RFID in companies with at least 10 employees (in %)

	2009	2011	2014
EU (28 countries)	3	4	10
EU (27 countries)	3	4	10
Belgium	3	4	17
Bulgaria	2	3	18
Czech Republic	3	4	6
Denmark	2	3	11
Germany	4	6	14
Estonia	2	3	8
Ireland	2	6	6
Greece	n/a	2	4
Spain	4	6	11
France	3	2	7
<b>Croatia</b>	<b>4</b>	<b>7</b>	<b>12</b>
Italy	3	3	11
Cyprus	1	3	8
Latvia	n/a	3	8
Lithuania	3	7	11
Luxembourg	2	5	15
Hungary	2	3	7
Malta	n/a	7	15
Netherlands	9	2	12
Austria	4	6	18
Poland	3	2	6
Portugal	2	3	14
Romania	1	1	8
Slovenia	3	5	13
Slovakia	4	8	12
Finland	8	8	21
Sweden	2	3	9
United Kingdom	2	1	6
Iceland	n/a	n/a	9
Norway	1	3	8
Republic of Macedonia	n/a	6	15

Source: Eurostat, Database. Available at: <http://ec.europa.eu/eurostat/web/products-datasets/-/tin00126> (access March 17 2015)

The sudden entry of foreign retailers is the beginning of the modern development of the retail structure in Croatia whose development was affected by the recession from 2008, which has slowed down the development of the retail structure (Dunković et al., 2010, p. 183). As a result of the economic crisis there has been stagnation of investment in trade sector.

In 2014 Zagreb hosted the first RFID conference focusing on the need to introduce new technologies, because in Croatia only a few companies successfully applied RFID technology (first RFID Conference, 2014). The introduction of new technologies into the domestic market is limited due to the high cost of RFID tag. However, despite the high prices and the recession, the domestic retailers should invest more in new technologies as the retail is one of the most important sectors in all national economies. In addition, by using RFID technology Croatia would strengthen its position in the region and ensure a better starting position for business expansion (Dujak et al., 2011, p. 268).

### **2.1. Advantages and disadvantages of the application of RFID technology in retail**

The benefit of using RFID technology in the supply chain is to collect data from various objects that are, after the transfer of information in digital format, available to all users. Also, RFID technology has a great advantage in locating individual objects within a plant or warehouse or at another location in the supply chain. At the same time it can be an aggravating factor to collect huge amounts of data in enterprise operating systems. Reading several tags at the same time can lead to a collision and ultimately loss of data - therefore anti-collision algorithms are applied, while research in new methods for the prevention of such phenomena are still developing (Kaur et al., 2011, p. 154).

RFID tag IDs indicate the individual products, which leads to a gradual reduction of warehouse space in stores and move to JIT (Just-in-Time) business – in this way retailers can increase selling space (Dujak et al., 2011, p. 267). For refunds or product complaints buyers should not carry proof of purchase but the data on the location of purchase and time of purchase would be read out from the RFID tag. The implementation of RFID technology in the retail SCM represents a competitive advantage and the need to survive in the global market.

The savings in the supply chain generated by applying the RFID technology can be seen in the employee costs reduction due to increasing automation in business processes (Delač et al., 2013, p. 194). The implementation of RFID technology in retail reduces the possibility of theft of products by customers and employees, increases financial benefits, enables effective inventory management, reduces labor costs and gives a better view of the situation on the shelves. Although there is a great advantage for the business, during the introduction of RFID technology retailers are faced with the problem of high cost of RFID tags, which limits the large-scale use of this technology (Dujak 2006, p. 102). For this reason it is not implemented for labeling consumer goods and food products, but only high value products and clothing.

Greater application of RFID technology will affect the price reduction, and a prerequisite for the widespread adoption of this technology is the introduction of

universal standards that support all interested parties. After several years of using RFID technology large number of retailers note that marking of transport packaging with the disposable RFID tag is too expensive and the line codes give the same effect (Dunković, 2011, p. 55).

In the retail sales of consumer goods some technological solutions, that should be useful to customers, retailers and suppliers, are tested in the *Extra Future Store*, where the customer would have a PSA (Personal Shopping Assistant) on the trolley and all the products that the customer buys would be scanned. Therefore the buyer could have access to the list with prices and product information (Dujak 2006, p. 100). Metro Group opened the first Future Store in 2003 in Rheinberg, Germany and in 2008 in the village Tonisvorst where customers could pay by mobile phone. They recorded a successful business over several years (Metro Group, 2014). Unfortunately, this way of buying proved to be flawed because the scanner that should identify all the products cannot read products which have a metal surface or when the signal from the RFID tag passes through the liquid (Dunković, 2011, p. 55). Table 3 shows the effects of the material on the RFID communication.

**Table 3.** Effect of different materials on RFID communication

<b>Composition of materials</b>	<b>Effects on RF signals</b>
glass	attenuation/damping
cans	the effect of multiple transmission/reflection
human/animal body	absorption/frequency oscillation/reflection
metal	reflection
plastic	frequency oscillation (dielectric effect)

Source: Sweeney, J.P. (2010). RFID for Dummies. USA: John Wiley & Sons. p. 164

Some of the favorable effects of RFID are preventing the return of expired products in the supply chain as well as falsification disabled by unique RFID tags.

Problems related to consumer privacy are due to fear that the goods marked with RFID tag IDs can be monitored and after purchasing, especially if the RFID tag contains the EPC code that shows the information about the product together with the customer's personal information (Delač et al., 2013, p. 194). Certain studies found that despite the economic crisis and lower purchasing power, the most important criteria for selection of stores is the quality of the service provided, the speed of purchase, range and quality of services, while lower prices of products are not crucial (Druzijanic & Druzijanic, 2014, p. 211).

Elimination of defects and the introduction of new and better solutions and standards of RFID technology should encourage the retail sector to invest more. One of the reasons for refusal of the application of RFID technology in the retail sector is that it increases the surplus labor force which would make employees to resist the introduction of this technology.

## 2.2. Privacy protection in the use of RFID technology

The main challenges of the implementation and acceptance of RFID technology are related to privacy, lack of standardization, high cost, the reluctance of employees to embrace new technology, the need to redesign business processes, difficulties in the integration of data and reliability. A greatest challenge of RFID technology is the problem related to consumer privacy, which will need to be fully addressed before RFID acceptance in the business world as a new and safe technological solution, especially in retail. The advancement of technology will solve most of the challenges of implementation of RFID, but in order to solve the problem of privacy it will be necessary to involve other professions as privacy issue is also a sociological problem.

Existing RFID protocols completely neglect the protection of consumer privacy because they are primarily designed to enable optimal communication between the transponder and reader. Privacy advocates point out that the purchased products labeled by RFID tag can be monitored after purchasing. Each RFID label contains its own unique identification number that is transmitted to readers so it can monitor the person that is not even aware of. An even bigger problem may arise if personal data of the owner is stored along with the identification number. In this way, one can follow the behavior of consumers and outside stores. EPC code contains additional information about the product, which can detect things like the size of garments, preferences in clothing, medicines that are subsequently used, favorite shops, and the number of purchases in combination with the personal information of the buyer.

With the ever-growing application of RFID, big problems with the protection of consumer privacy will appear, because now there is no way to get to the users turn off the signal that RFID transponders transmit to the reader and so reveal the behavior of consumers having bought a product marked with RFID Labelling (Delač, 2012, p. 28). The basic and inalienable right of every individual is right to privacy that should not be jeopardized by any higher interests of the corporation. Unlimited possibilities of application of RFID technology in applications requiring identification and data reading opens many possibilities for misuse of this technology.

RFID technology is vulnerable to interference with radio signals, wiretaps, physical attacks (change of electronic property), denial of service attacks (interfering with the radio signal), forgery (change of product identification), unauthorized analysis of communication (interception) and fraud (Carnet, 2007). In order to increase security and to reduce the vulnerability of RFID technology following security measures can be applied:

- Self-destruct or deactivation of the transponder at cash counters in order to prevent further product monitoring;
- The Faraday cage is a container which blocks the radio signals of certain frequencies and thus protects the privacy of RFID transponders;
- Blocking passive RFID transponder disables the RFID reader and can be used against attacks on RFID systems;
- Frequent changes of cryptographic key in order to prevent unauthorized reading and tracking transponders;
- Informing consumers about a product that has an RFID transponder (consumer rights);

- Hash functions:
  - method by which the transponder responds only to his reader,
  - randomized hash lock that could allow unauthorized transponder monitoring;
- PRF (Pseudo-Random Function) authorization that ensures privacy tag that occurs, using a common key and PRF Insurance messages between the transponder and reader;
- TBP (Tree-Based Private) authorization that reduces the load on the server (with methods based on hash functions) which is proportional to the number of transponders;
- HB (Hopper and Blum) authorization use symmetric cryptographic key and provides protection against active and passive surveillance;
- A number of authorization algorithms methods that do not use encryption.

RFID technology is available for more than 50 years and is applied in various fields of human activity and has permeated modern society. So, it is necessary to carefully apply and find solutions that would help in the implementation of RFID technology in sensitive areas such as medicine. VeriChip Company developed the first commercial biochip that is intended for use on humans in 2001. VeriChip's RFID tag, with the size of a grain of rice installed under the skin, activates the ID number near the reader that allows access to personal data (Žubrinić, 2004, p.5 -6).

Observed from the point of retail and consumer protection, information on the buying habits of individuals, available and collected on the basis of purchasing tickets or using biometric passports, completely controls individuals and therefore any abuses of the data available should be prevented (Fičko, 2009, p.65). For more effective implementation of RFID technology a better understanding of all the possibilities of this technology is required.

### **3. RESEARCH OF YOUNGER CONSUMERS ATTITUDES ABOUT THE PROBLEM OF PRIVACY WHEN USING RFID TECHNOLOGY**

This section will show empirical research on the attitudes of young consumers related to the problem of privacy in the use of RFID technology. The aim of this study is to examine the awareness of younger generation of the pros and cons of RFID technology and its impact on privacy and personal data protection.

In this research the survey was taken on student population. Research took place in April 2015. The quantitative data was collected through online questionnaire in Google Docs. Questionnaire was distributed through social networking platform – Facebook and Google Classroom.

The questionnaire consisted of three main parts: (1) General information, (2) Familiarity of the respondents with RFID technology, (3) Users' confidentiality towards RFID technology. An online questionnaire included questions of different types: one choice question, multiple choice questions and Likert scale ranking questions.

Large sample size provides more data for analysis. The number of respondents fulfills the first criterion of representativeness of research according to which N must

be greater than 30. To ensure high explanatory power of result, the target respondents of this survey is 151. Table 4 shows relative frequency of sample characteristics.

**Table 4.** Characteristics of the sample

RESPONDENTS (N=151)		
Gender	Male	61
	Female	90
Year	15-20	5
	21-25	96
	26-30	21
	31-35	12
	35<	17
Status	unemployed	11
	student	75
	employed	65

Source: own work

According to the gender structure of the sample there were 90 of female and 61 of male respondents at the sample. As shown in table 4 above, majority of respondents aged between 21 and 30, in which almost 65% of respondents are from the age group of 21-25, followed by the group of 26-30, which occupied 14% of the population. The largest proportion of respondents are students (almost 50%), while 43 % of respondents (i.e. 65) are employed. Only 7% of the participants in survey are unemployed.

### 3.1. Research results

The statistical program SPSS and MS Excel are used for the analysis of the results. Tables and graphs with accompanying explanations of the research results are presented below.

According to Table 5 it is evident how demographic variable years and the variable importance of the shopping speed correlate to the level of significance of 1%. Therefore, we can conclude that the shopping speed is more important to younger respondents.

**Table 5.** The correlation between demographic variable years with the variable importance of the shopping speed

		Importance of the shopping speed	Years
Importance of the shopping speed	Pearson Correlation	1	,263**
	Sig. (2-tailed)		,001
	N	151	151
Years	Pearson Correlation	,263**	1
	Sig. (2-tailed)	,001	
	N	151	151

\*\*Correlation is significant at the significance level of 1%

Source: own work

For easier understanding the table 6 gives an overview of the responses to the variables of importance of the shopping speed and demographic variables year.

**Table 6.** The importance of variables shopping speed and demographic variable years

Years	Importance of the shopping speed	Number of respondents	% of respondents
15-20	Yes	5	100,00%
	Total	5	
21-25	Yes	76	79,17%
	No	18	18,75%
	Not sure	2	2,08%
	Total	96	
26-30	Yes	13	61,90%
	No	6	28,57%
	Not sure	2	9,52%
	Total	21	
31-35	Yes	6	50,00%
	No	6	50,00%
	Total	12	
35<	Yes	9	52,94%
	No	6	35,29%
	Not sure	2	11,76%
	Total	17	
	Total	151	

Source: own work

From the above table it can be concluded that shopping speed is more important to younger respondents. For respondents of 15-20 years of age the shopping speed is of great importance (100%). The group of respondents aged from 21-25 years has also showed great interest in the speed of shopping (almost 80%). Increased age of the respondents reduces the importance of shopping speed, thus it is essential to those 62% aged between 26 and 30 years, and for about 50% aged from 30 and over.

The following Table 7 shows the correlation between the importance of speed of shopping and demographic characteristic gender.

**Table 7.** The correlation between demographic variable gender with the variable importance of the shopping speed

		Importance of the shopping speed	Gender
Importance of speed shopping	Pearson Correlation	1	-,189*
	Sig. (2-tailed)		,020
	N	151	151
Gender	Pearson Correlation	-,189*	1
	Sig. (2-tailed)	,020	
	N	151	151

\* Correlation is significant at the significance level of 1%

Source: own work

For a better understanding Table 8 gives an overview of the responses to the variables of importance of speed of shopping and demographic variable gender.

**Table 8.** Overview of answers to the importance of variables shopping speed and demographic variable gender

Gender	Shopping speed	Number of respondents	% of respondents
Male	Yes	36	59,02%
	No	23	37,70%
	Not sure	2	3,28%
	Total men	61	
Female	Yes	73	81,11%
	No	13	14,44%
	Not sure	4	4,44%
	Total women	90	
	<b>Total</b>	<b>151</b>	

Source: own work

According to Table 8 it is evident that the shopping speed is more important to female than male respondents, 81% and 59% respectively.

The following table shows a familiarity with RFID technology and demographic variable years. According to the answers of the respondents there is no significant difference in the ratio of years and knowledge of RFID technology and it cannot be concluded that these two variables are correlated. Most of the respondents, regardless of age, are poorly familiar with RFID technology. Majority of respondents unfamiliar with RFID technology are those over 35 years old (almost 90%). Also, respondents aged between 21-25 and those 26-30 are poorly familiar with RFID technology, 76% and 67% respectively.

**Table 9.** Overview of answers to the importance of variables familiarity with RFID technology and demographic variable years

Years	Familiarity with RFID technology	Number of respondents	% of respondents
15-20	Poorly	5	100,00%
	Total	5	
21-25	Good	18	18,75%
	Great	5	5,21%
	Poorly	73	76,04%
	Total	96	
26-30	Good	5	23,81%
	Great	2	9,52%
	Poorly	14	66,67%
	Total	21	
31-35	Good	6	50,00%
	Poorly	6	50,00%
	Total	12	
35<	Good	1	5,88%
	Great	1	5,88%

	Poorly	15	88,24%
	Total	17	
	<b>Total</b>	<b>151</b>	

Source: own work

The following table 10 gives an overview of the responses to variables familiarity with RFID technology and demographic variable gender. Regarding the poor familiarity with RFID technology the results are similar for both, females and males. 71% of male and nearly 78% of female respondents emphasized poor familiarity with RFID technology.

**Table 10.** Overview of answers to the importance of variables familiarity with RFID technology and demographic variable gender

Gender	Familiarity with RFID technology	Number of respondents	% of respondents
Male	Good	11	18,03%
	Great	7	11,48%
	Poorly	43	70,49%
	Total men	61	
Female	Good	19	21,11%
	Great	1	1,11%
	Poorly	70	77,78%
	Total women	90	
	<b>Total</b>	<b>151</b>	

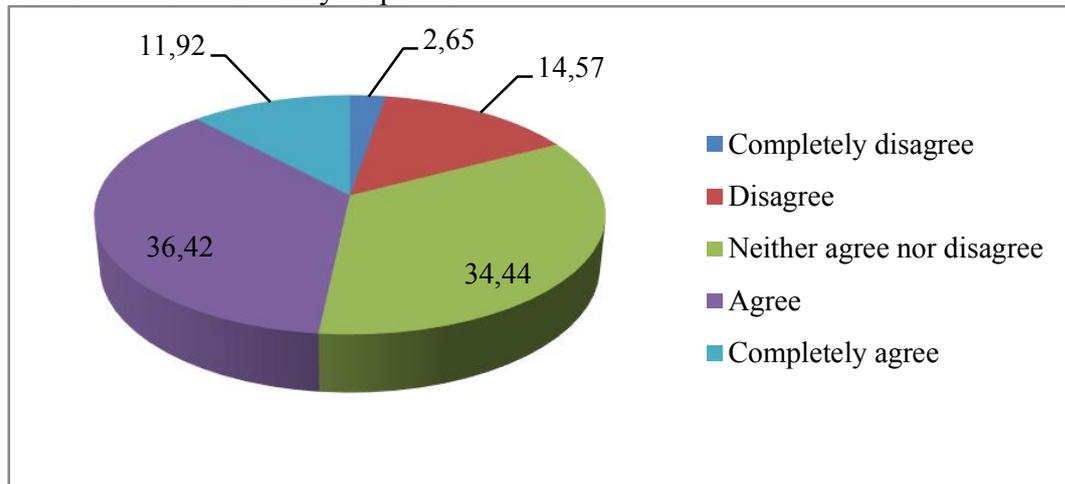
Source: own work

When talking about trust of respondents in RFID technology, 40% of respondents agreed with the statement that the RFID tag can seriously impair a person's privacy if unauthorized persons followed his movements and behavior. 29% of the respondents disagreed with the above statement where only 9% of them completely disagreed with the statement. The conclusion is that the opinions of people are divided equally to those who agree and those who disagree with the above statement.

Regarding the claim that by the use of RFID technology unauthorized person can get information about drugs we use and the diseases we suffer, 42% of the respondents agreed with the statement, while nearly 31% of them disagreed with the above statement (11% of them completely disagreed with the above statement).

As for the reduction of congestion at the box offices, the respondents believe that RFID technology can have a positive impact on its reduction. Almost half of the respondents (49%) agree with this statement, while only 6% completely disagree.

**Figure 1.** Introduction of RFID technology into all levels of the supply chain will enable better availability of products



Source: own work

As evident in Figure 1, the agreement with the above statement can be seen in 48% of the respondents, of which 12% completely agree. The conclusion is that almost half of respondents see the advantage in deploying RFID technology because it increases the product availability. The respondents also have a positive view on the possibility that RFID technology offers regarding the reduction of loss of luggage at airports. Almost 58% of respondents agreed with this statement, of which 14% completely agree with it.

### 3.2. Limitations of the research and recommendations for future research

In order to effectively use the conclusions of a survey it is necessary to be aware of certain limitations of the study that can be classified into several categories.

The first limitation of this study is the sample size. In fact, as previously mentioned 151 of respondents is acceptable for the research to be valid. But it is always easier to make general conclusions on the greater number of subjects. Another constraint is the limited control of the examining sample as it is electronically conducted survey research. The third limitation relates to the subjective assessment of the respondents by using a questionnaire and Likert scale.

This research has shown that people are still not entirely familiar with RFID technology and its possible positive impact. It is essential to point out how buying speed is important to people. But at the same time the confidentiality and secrecy of personal data is also crucial. It is necessary to explain the advantages of RFID technology and to convince people that the confidentiality of information is guaranteed in order to gain the trust of consumers towards this technology. In future research, the focus should put more on consumer confidence to RFID technology.

#### 4. CONCLUSION

Strengthening of market competition is increasingly coming to the fore in the global market. Increased competition, financial instability and uncertainty of the market require a constant reduction of operating costs, and increase in productivity and efficiency. The solution is sought in the application of modern information technologies that have a major impact on the improvement of the business.

Globalization, computerization and internationalization of the industry have a major impact on retail businesses and contribute to the introduction of RFID technology for labeling and sale of products in the business strategy. In this way, the RFID technology is becoming the key to successful retail which is one of the fastest growing activities. The aim of introducing RFID technology in retail is to reduce costs, increase customer satisfaction, which would result in increased profitability of enterprises.

Croatian retailers are trying to adapt to global trends, by the introduction of new information technologies in order to strengthen its position in the region, which would contribute to better relations with customers and to better business organization. The advent of recession from the 2008 slowed down the development of retail structure in Croatia. The increasing application of RFID will affect the RFID tag price reduction and enable the implementation of this technology on consumer goods. For now, the technology is applicable only for the labeling of products of great value. Considering the benefits that RFID technology delivers, the application of this technology in modern business is expected to increase, that requires evaluation of the cost-effectiveness of introducing. Many companies are disappointed with the slow return on investment, which brings into question the creation of added value by using RFID technology.

Challenges of implementation and acceptance of RFID technology are related to consumer privacy, lack of standardization, high cost tag's, rejection of new technologies by employees, needs to redesign business processes and the reliability of RFID technology. Unlimited application of RFID technology in the future may threaten the inalienable right of every individual to privacy and protection of personal data by unauthorized persons.

The research conducted in this study showed that the speed of purchasing is very important to people, but also the confidentiality and protection of personal data. Young people should be more aware of the benefits that RFID technology provides since they are still not familiar with the advantages that this technology can provide. Also, it is important to convince them in guaranteed confidentiality of data when using RFID technology.

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