Challenges of introducing intelligent packaging to the retail market of AP Vojvodina

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Abstract
The aim of this paper is to analyse the readiness of retailers in the AP Vojvodina market to adopt the concept of intelligent packaging. The importance and role of intelligent packaging as an integral part of the final product are highlighted in the theoretical section of the research. The most common benefits and obstacles on the market are identified. In the empirical section of the paper, the benefits and obstacles that appear when intelligent packaging is introduced are analysed on the sample of 23 trading companies on the territory of AP Vojvodina. The results showed significant variations among retailers depending on the size of the company, sales volume, number of employees and standards adopted. Based on the results obtained, a set of measures and procedures is proposed that should be implemented to encourage the implementation of intelligent packaging in the AP Vojvodina market. Suggestions for future research are provided in the paper.

Introduction

In recent years, the global market has seen a growing trend in the introduction of new packaging technologies for consumer goods (Fast Moving Consumer Goods), mainly food and organic products (Jurjević, Bogićević, Đokić & Matkovski, 2019, Cappelli, D'Ascenzo, Ruggieri, Rossetti & Scalingi, 2019; Drăgoi et al., 2018). New packaging system technologies, such as intelligent and interactive packaging, are evolving in response to current industrial production trends and consumer demands to preserve product use value, i.e. growing needs for practical packaging, fresh and tasty food products with extended shelf life and quality control (Dainelli, Gontard, Spyropoulos, Zondervan-van den Beuken & Tobback, 2008). Changes in the retail sector, such as market internationalization and globalization, have resulted in longer supply chains and changes in consumer buying habits, which have led to shortening of shopping time and having as much information as possible to make that purchase safer (Končar, Marić & Vukmirović, 2019, Fedorko, Bacik & Gavurova, 2018; Gerpott, 2018). Such tendencies are the driving force for the development of new and improved packaging concepts, which extend the shelf life of a packaged product and enable more efficient maintaining and monitoring of its use value.

Unlike traditional packaging, which primarily has a protective and commercial function, intelligent packaging offers consumers the ability to communicate with packaged content, better protective function in the physical distribution process, greater benefits in terms of more practical use of packaging and preserving the characteristics of the packaged product itself (Vanderroost, Ragaert, Devlieghere & De Meulenaer, 2014). Intelligent packaging enables

all participants in the marketing channel, primarily the final consumer, to gather information about the production process and product history (e.g. nutritional composition, origin and quality of raw materials, place of production, storage conditions, temperature, humidity, microorganisms, etc.) as well as to track information about changes within the packaging (e.g. content contamination, freshness, etc.). There are three main technologies for realizing intelligent packaging, such as: sensors (e.g. chemical sensors for identification of CO_2, H_2S, NH_3, etc.), indicators (e.g. TTI indicators) and radio frequency identification (RFID systems) (Realin & Marcos, 2014).

Given the above characteristics, intelligent packaging has become widely used in retail. Some studies indicate a significant market share of intelligent packaging. For instance, the share of packaging with chemical sensors is 7% in the total packaging produced, the share of self-venting packaging is 6%, the share of packaging equipped with TTI indicators is 2%, while the share of RFID systems is already around 16% (Shafiq, 2019; Bledsoe & Rasco, 2018; Dainelli et al., 2008). As a result of the use of innovative technological solutions, the key benefit of intelligent packaging is reflected in the ability to reconstruct the entire supply chain, from product manufacturing (place of production, composition of raw materials), packaging methods and conditions, distribution and storage, to its presentation and final consumption, and the process of disposal and/or reverse logistics (Marić, 2019).

Despite the obvious advantages, the implementation of the intelligent packaging concept and innovative/digital technologies is not yet fully accepted in all markets (Shafiq, 2019; Ruggieri, Savastano, Scalingi, Bala & D'Ascenzo, 2018). This is especially true for trading companies in developing countries, which, often due to expensive technology, decide not to change their placement policy (Končar, Grubor, Marić, Vukmirović & Đokić, 2018; Andrei & Darvasi, 2012). On the national market and the market of AP Vojvodina, there are few retailers who have fully embraced the concept. Therefore, *the subject of this paper* is the analysis of the possibilities of applying intelligent packaging in the retail market of AP Vojvodina. *The aim of the paper* is to identify the benefits and obstacles that emerge from its introduction. An empirical study was conducted on a sample of 23 companies in the consumer goods retail segment on the expected benefits and obstacles to introducing intelligent systems. *The practical significance of the paper* is reflected in the possibility of applying the obtained results in practice. Based on the research results, retail management can identify clear obstacles that limit the introduction of intelligent packaging, and optimize its implementation by undertaking a set of specific measures and procedures to minimize such obstacles.

1. Theoretical background

The prevailing view in the literature is that intelligent packaging is a specific type of packaging that, unlike conventional forms, is equipped with sensors and devices used to detect, read, monitor, record and transmit certain quality information of a packaged product (Kocetkovs, Muizniece-Brasava & Veipa, 2019). Accordingly, intelligent packaging is equipped with a variety of hardware components, the most common being NFC technology, RFID systems, TTI indicators and bio-sensors (Prasad & Kochhar, 2014). In retail, NCF - a short-range data technology, is most commonly used on meat and meat products packaging. NCF technology connects packaging to mobile phones and provides all the information that is needed by the final consumer, such as information on allergens, product freshness, storage conditions, etc. If the product contains some potentially harmful ingredients or allergens, the mobile phone will alert the consumer to their presence. In addition to NFC interaction, this type of packaging also contains a hidden UHF antenna and chip to prevent the unauthorized opening, taking and use of packaged product (Ortego et al., 2012). RFID systems, on the other hand, are affixed to product packaging and are used to transmit product information over radio frequencies. (Radio Frequency Identification). The RFID sticker is glued to the package or packaging (product, transport packaging, pallets, containers, etc.). This enables the movement of the product to be monitored throughout all production and distribution operations. In addition to retail, they are widely used throughout the physical distribution system (Rakić Sokolović, Ostojić, Lazarević & Stanovski, 2008).

NCF and RFID technologies enable timely exchange of information between all supply chain participants, thus enhancing the efficient consumer response (ECR). The goal of these technologies is, in fact, information connectivity that will enable the most accurate and efficient

transfer of data across the supply chain (Lovreta, Končar, Petković, Bogetić & Stojković, 2019).

On the other hand, TTI indicators, chemical and bio-sensors are used for communication between the packaging itself and the packaged contents. These sensors embedded in the packaging provide information on the presence of gases, humidity, storage temperature, product storage conditions, freshness, contamination, presence of allergens, etc. The information can be sent to smart devices or be visible to final consumers at the point of product display, such as colour changing of the packaging or colour changing of the special sensors indicated on the packaging (Rachmelia, & Imawan, 2018).

As the biggest problem with intelligent packaging, the studies (Realini & Marcos, 2014; Vanderroost et al., 2014; Dainelli et al., 2008) emphasize the economic justification and the fact that production of such packaging often requires high costs and investment. The implementation of modern technology that makes packaging intelligent and/or smart increases the cost of packaging itself, so packaging innovations should have a useful end result that would offset the additional cost of using modern technology. This is especially emphasized in transition countries where low consumer purchasing power can be a serious limiting factor, especially in the retail sector.

In addition to price, recent research defines satisfaction with traditional packaging, high costs and long installation time, unqualified employees, problems of standardization and certification, unclear performance of intelligent packaging, lack of modern devices and technologies, commercial unsustainability, etc. as limiting factors (Fang, Zhao, Warner & Johnson, 2017; Ghaani, Cozzolino, Castelli & Farris, 2016; Vanderroost et al., 2014).

Although it is assumed that the global intelligent and interactive packaging market will grow at a rate of 3% annually and account for about 25% of the total global packaging market with a value of over US $ 6.4 billion (Dobrucka, 2013), the concept of introducing intelligent packaging into supply chains and the retail sector is in the initial phase of implementation on the national and AP Vojvodina markets. Despite the obvious benefits, there are major obstacles and limitations to its full exploitation. In this context, there is a need to analyse and define the benefits, on the one hand, and the limitations or obstacles to introducing intelligent packaging into the retail

sector of AP Vojvodina, on the other hand. It is important to identify indicators that determine limitations for retailers and propose a set of measures and/or procedures to minimize these limitations.

2. Methodology

2.1. Aim and hypotheses

The aim of the research is to identify the benefits and obstacles to the implementation of intelligent packaging in the retail market of AP Vojvodina. The main task is to determine whether different benefits and limitations of retailers depend on the size of a trading company, sales volume, number of employees and standards adopted. The aim and task of the research thus set out were operationalized through two basic research hypotheses:

H_1 – Obstacles to the introduction of intelligent packaging in trading companies in the market of AP Vojvodina vary depending on the size of a trading company, sales volume, number of employees and adopted standards.

H_2 – Benefits of introducing intelligent packaging in trading companies in the market of AP Vojvodina vary depending on the size of a trading company, sales volume, number of employees and standards adopted.

2.2. Research sample

The research included 23 trading companies in the retail segment of consumer goods, which operate in the market of AP Vojvodina. Retailers are grouped by size, sales volume, number of employees and standards adopted. In terms of size, retailers are equally grouped. Small trading companies represented the biggest portion of the sample – 30.4%, followed by middle-sized trading companies – 26.1% and micro trading companies – 26.1%, while the least represented were large retail chains –17.4%.

In terms of business standards adopted, trading companies are divided into two groups. A greater number of retailers in the sample, i.e. 73.9%, implemented the ISO9000 standard. The second group of respondents implemented the standards such as ISO9000 + HACCP + BRC standard, a total of 26.1% of the sample.

The sample can also be broken down by sales (operating income) in 2018, as well as by the number of employees.

The following table (Table 1) shows the distribution of trading companies in the sample by sales volume and number of employees.

Table 1 Research sample size

Sales volume in 2018	No.	%	Number of employees	No.	%
up to 100,000€	6	26.1	up to 10	5	21.8
up to 500,000€	5	21.8	10 - 50	7	30.4
up to 1,000,000€	8	32.5	50 - 250	6	26.1
over 1,000,000 €	4	17.4	over 250	5	21.8

Source: The Authors

2.3. Variables and data analysis

The statistical analysis program SPSS 20 was used to process the data. In order to get familiarized with the sample, descriptive statistics was used - frequencies for independent variables of nominal and ordinal levels of measurement and descriptive indicators for dependent variables. One-way analysis of variables (ANOVA) and T test for independent samples were used to test the hypotheses. Trading company's size, sales volume, the number of employees and the standards adopted are independent variables, while dependent variables are benefits and obstacles to the introduction of intelligent packaging in the retail market of AP Vojvodina, obtained as the average of the respondents' answers to the questionnaires.

2.4. Research procedure

The research was realized as part of the research project "Possibilities of applying intelligent packaging as a segment of green marketing logistics in the function of sustainable development in the market of AP Vojvodina" in the period July-September 2019. Based on the report of the Serbian Business Registers Agency (SBRA), a sample of 23 trade companies with headquarters in AP Vojvodina was selected. Trading companies are equally divided into sub-groups (strata) according to their size, income, number of employees and standards. The questionnaire was electronically distributed to managers (middle and top level). The questionnaire consisted of two sets of statements regarding the use of intelligent packaging, as follows: 10 statements for benefits and 11 statements for obstacles. Respondents expressed their agreement with the proposed statements on

the five-point Likert-type scale (from 1 - completely disagree, to 5 – completely agree).

3. Results

In order to analyse the respondents' answers to the proposed statements about the benefits of introducing intelligent packaging, the following table summarizes (Table 2) the average ratings.

Table 2 Descriptive indicators of expected benefits from intelligent packaging in the retail market of AP Vojvodina

No.	Indicators	Min	Max	Mean	SD
1	Income growth	2.00	4.00	3.21	.79
2	Export growth	2.00	5.00	3.73	.81
3	More efficient supply chain	3.00	5.00	4.13	.62
4	Lower inventory costs	1.00	5.00	2.78	1.27
5	Delivery timeliness	1.00	5.00	3.17	1.19
6	Speeding up of physical and manipulative operations	2.00	5.00	3.91	.73
7	More efficient reverse logistics	3.00	5.00	3.95	.47
8	Easier product tracking	1.00	5.00	3.39	1.15
9	Lifetime extension	1.00	5.00	3.60	.94
10	More attractive packaging	2.00	5.00	3.52	.79

Source: The Authors

Based on these indicators, it can be concluded that retailers mostly agree with the statement that the use of intelligent packaging will increase the efficiency of the supply chain, i.e. facilitate the synchronization of production, transport and distribution plans (M=4.13). The respondents are most unanimous regarding this statement, rating it from 3 to 5. On the other hand, they least agree that the introduction of intelligent packaging will affect the reduction in inventory costs (M=2.78). Respondents rated this statement from 1 to 5, and the recorded standard deviation was highest for this question (SD=1.27). Significant benefits for retailers from the introduction of intelligent packaging include a more efficient reverse logistics process (M=3.95), i.e. reducing the rate of product being returned from a retail store due to its expiration date and/or defect, as well as speeding up physical and manipulative operations (M=3.91). Many retailers also expect significant export growth to markets that have already integrated intelligent packaging into their business systems, such as markets in EU, China, etc. (M=3.73). After the benefits are analysed, Table 3 shows the average values for the obstacles.

Table 3 Descriptive indicators of obstacles to the introduction of intelligent packaging in the retail market of AP Vojvodina

No.	Indicators	Min	Max	Mean	SD
1	Existing packaging	3.00	5.00	3.91	.66
2	Price	3.00	4.00	3.73	.44
3	Initial costs	2.00	3.00	2.73	.44
4	Different criteria of usefulness	2.00	4.00	3.30	.87
5	Long introduction period	4.00	5.00	4.56	.50
6	Standardization	3.00	5.00	4.47	.89
7	Consumer purchasing power	3.00	4.00	3.56	.50
8	Employees' lack of training	3.00	4.00	3.69	.47
9	Lack of technology	4.00	5.00	4.47	.51
10	Practical application	2.00	4.00	2.82	.83
11	Unsustainability	3.00	5.00	3.91	.66

Source: The Authors

In the group of indicators describing limitations, retailers largely agree with the statement that it takes a long time to fully implement intelligent packaging and that this period is often not in line with the seasonal character of the production and distribution of products, especially for easily perishable foodstuffs, fruits and vegetables (M=4.56). Respondents provided only ratings 4 (agree) and 5 (completely agree) for this statement. Identical average ratings are provided for standardization and the lack of modern technology (M=4.47). In accordance with the indicated answers, respondents from trading companies believe that standardization processes and procedures for obtaining different approvals from competent institutions in the market of AP Vojvodina can have a restrictive influence on the implementation of intelligent packaging. For respondents, the lack of modern technology and modern IT equipment and platforms is considered a limitation. Respondents least agree with the statement that the introduction of intelligent packaging will cause high initial implementation costs and significantly reduce profitability (M=2.73). The ratings for this statement were 2 (disagree) and 3 (undecided). For retailers, the real practical benefit, i.e. the practical application of intelligent packaging, is a significant indicator, which they do not consider to be a limiting factor (M=2.82).

In order to test the hypotheses, one-way analysis of variance (ANOVA) and T test for independent samples were applied.

First, it was examined whether there was a statistically significant difference in obstacles for the implementation of intelligent packaging in the retail market of AP Vojvodina, and whether these limitations differ depending on the trading company's size, sales volume, number of employees and standards adopted.

Applied analysis showed that there is a statistically significant difference between obstacles that appear in trading companies in the market of AP Vojvodina, depending on the size of the company (F(3.23)=61.542, p<0.001). Table 4 shows the result of the Scheffe's Post hoc test. Based on the test used, it is found that all four groups differ in the assessment of obstacles to the introduction of intelligent packaging. Independent retailers or micro trading companies provide the highest rating for limitations. The lowest significance to limitations is given by small companies, as limitations grow with the growth of a company.

Table 4 Differences in obstacles in relation to trading companies of different sizes

Trading company size	1	2	3	4
Small	3.3636			
Medium-sized		3.7273		
Large			3.9091	
Micro				4.0000*

Source: The Authors

Independent retailers cite lack of technology, satisfaction with existing packaging, and price as the biggest problem. On the other hand, the biggest problem of large retail chains is the long period required to introduce intelligent packaging systems and unskilled employees.

One-way analysis of variance was applied in order to compare the differences between trading companies with different sales volume in 2018. F test is statistically significant and is 17.115, while the significance is less than 0.001. Respondents with revenue of up to € 1,000,000 in 2018 provided the lowest average ratings of limitations, while retailers with a sales volume of up to € 100,000 provided the highest ratings. Table 5 shows the result of the Scheffe's Post hoc test.

Table 5 Differences in obstacles in relation to different sales volume of trading companies

Sales volume in 2018	1	2	3	4
up to 1,000,000 €	3.3636			
over 1,000,000 €		3.8231		
up to 500,000 €			4.2200	
up to 100,000 €				4.3700*

Source: The Authors

The most pressing problem for retailers with a small annual turnover (up to € 100,000) is the implementation of expensive technology, price

and high initial costs of introducing intelligent packaging.

In terms of the number of employees, retailers are also divided into four strata. Using one-way analysis of variance, the difference between these strata was examined. The obtained results show that the difference is statistically significant. F test is 14.15, p<0.001. According to the Scheffe's Post hoc test, it can be concluded that there is a difference between all four groups. The highest rating for limitations is provided by trading companies with up to 10 employees, while the lowest ratings are provided by those with up to 250 employees. Table 6 shows the differences obtained by the Scheffe's Post hoc test.

Table 6 Differences in obstacles between trading companies with different numbers of employees

Sales volume in 2018	1	2	3	4
up to 250	3.3636			
over 250		3.8340		
up to 50			4.1200	
up to 10				4.2100*

Source: The Authors

The results show that the obstacles are higher and more pronounced in trading companies with fewer employees (less than 10 and from 10 to 50 employees). Besides the already mentioned problems related to the lack of modern technology and satisfaction with existing packaging, these companies emphasize the problem of unsustainability, i.e. the questionable commercial profitability of intelligent systems. On the other hand, companies with more than 250 employees cite the lack of skilled labour as the biggest problem.

Finally, trading companies are grouped into strata by adopted standards. The first group consists of retailers with the adopted ISO9000 standard, while the second group consists of those who have ISO9000 + HACCP + BRC standard. To analyse the differences between the two groups, a T test for independent samples was used. The obtained results indicate that the T test is statistically significant, i.e. there are statistically significant differences between the groups. Higher score and higher ratings for obstacles are reported by respondents in trading companies with ISO9000 standard implemented. Table 7 provides detailed results of the applied analysis.

Table 7 Differences in obstacles in trading companies with different standards

Standards	No	Mean	SD	T	Sig.
ISO9000	17	3.88	.67	27.67	.000
ISO9000+HACCP+BRC	6	3.36	.16		

Source: The Authors

Trade companies with the adopted ISO9000 standard identify a very long process of standardization and obtaining various permits, certificates and approvals from competent state and provincial institutions and associations as the biggest problem for the implementation of intelligent packaging in the market of AP Vojvodina.

Given the applied analysis and the results obtained, the first research hypothesis H_1 is accepted. It can be concluded that the obstacles for the introduction of intelligent packaging in trading companies in the market of AP Vojvodina are statistically significantly different depending on the trading company's size, sales volume, number of employees and standards adopted. In other words, different retailers face different obstacles, limitations and barriers to the implementation of intelligent packaging on the market of the AP Vojvodina.

After analysing differences in opinions on obstacles, it was examined whether there were differences between retailers in terms of the benefits they would expect from smart packaging. As in the previous cases, a series of one-way analyses of variance and a T test for independent samples were conducted. All the analyses showed that there was no statistically significant difference in the expected benefits between groups by trading company's size, sales volume, number of employees and standards adopted. There are no differences on the total score as well as in individual items. Table 8 shows the results of the analyses.

Table 8 Differences in trading companies in terms of the benefits from implementing intelligent packaging

| One-way analysis of variance	F test	Sig.
Size of trading companies	1.958	.155
Sales in 2018	1.061	.365
Number of employees	1.254	.324
T test for independent samples	**T test**	**Sig.**
Standards adopted	1.117	.277

Source: The Authors

Based on the analysis, it can be concluded that the second research hypothesis **H₂** is rejected and that retailers in the AP Vojvodina market, regardless of differences in size, income, number of employees and standards, have the same level of expectations and benefits from the introduction of intelligent packaging systems.

4. Discussion

The conducted research has shown that the biggest obstacles to the introduction of intelligent packaging systems in the retail market of AP Vojvodina are a long implementation period, standardization, lack of modern technology and satisfaction with conventional forms of packaging. In this way, the results of previous studies (Fang et al., 2017; Ghaani et al., 2016; Vanderroost et al., 2014; Dainelli et al., 2008) have been partially confirmed, where, in addition to the above indicators, price was identified as one of the primary obstacles. The reason for this discrepancy is the fact that the studies also included final consumers who identified the final retail price as the biggest obstacle to purchasing products in intelligent packaging.

A significant contribution of the conducted research is reflected in the fact that different obstacles were defined for different subgroups of retailers in the market of AP Vojvodina. It can be noticed that independent retailers, i.e. trading companies with the lowest operating income, a small number of employees, and no other standard adopted except ISO9000, provide higher average ratings for all statements on obstacles. The chart below summarizes the comparative view of average ratings for statistically significant obstacles between independent retailers and large retail chains in the AP Vojvodina market.
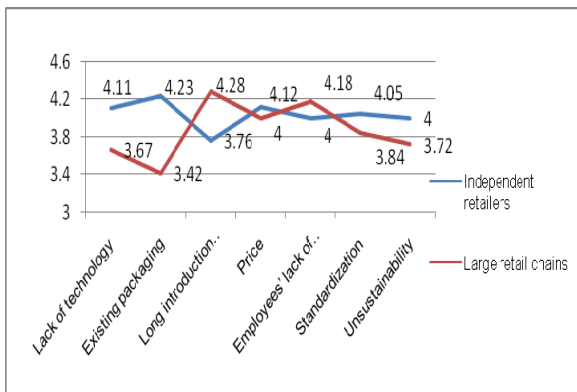
Figure 1   Average ratings of obstacles to the introduction of intelligent packaging in the market of AP Vojvodina
Source: The Authors.

In order to reduce the average ratings for all these obstacles, it is necessary that the competent state and provincial institutions undertake a whole set of measures and activities.

On the one hand, measures should target incentives for the introduction of intelligent packaging among all participants in the supply chain, and especially among independent retailers who experience the greatest problems. The measures should be directed towards tax breaks for economic entities introducing intelligent technologies, as well as taking appropriate measures in the form of co-financing the replacement of conventional packaging with intelligent systems. Furthermore, competent institutions should encourage all parties in the supply chain to participate jointly in EU funds financing the introduction of smart and intelligent packaging. In addition, professional associations would have to organize various training and retraining programs for employees in order to be able to work with modern technologies (Foerster-Pastor & Golowko,2018).

Trade policy makers, on the other hand, should fully align and harmonize national legislation and regulations on packaging and packaging material with the EU Directives and Regulations governing this field. Among others, these are: EU Directive on Packaging and Packaging Waste (94/62/EC); EU Directive relating to the labelling, presentation and advertising of foodstuffs (2000/13/EC); Regulation 1935/2004/EC for the safe use of active and intelligent Regulation 450/2009/EC of specific requirements for the marketing of active and intelligent materials and articles intended to come into contact with food packaging; etc. (Restuccia et al., 2010). At the same time, the Institute for Standardization of Serbia should harmonize Serbian SRPS ISO standards with international ISO standards, such as ISO 17366:2013 Supply chain applications of RFID - Product packaging; ISO 17367:2013 Supply chain applications of RFID - Product tagging, etc.

Conclusion

The research results, the analyses carried out and the hypotheses tested have shown that the retail market of AP Vojvodina shows a high degree of readiness to adopt intelligent packaging systems on the one hand, while having significant obstacles to its full implementation, on the other hand. All retailers tested, regardless of their size, revenue, number of employees and standards, are

equally aware of the benefits and advantages that such packaging would enable. However, the differences between them impose different obstacles to the full implementation of intelligent concepts in their business systems.

Independent retailers are facing the biggest problems. Removing their obstacles is not easy. It requires the simultaneous coordination of a set of measures and activities of all relevant institutions, professional associations and organizations. The problems faced by large retail chains are not so pronounced and it is assumed that they will be minimized with the removal of obstacles in independent retailers. What is common for all retailers is taking extensive steps regarding trade policy, where it is necessary to adopt a set of appropriate national standards and regulations, which must be fully aligned with EU legislative policy.

The shortcoming of the conducted research is reflected in the territorial limitation of the testing process solely to the sample of retailers who perform their principal activity and are headquartered in the territory of AP Vojvodina. The reasons for choosing this type of research sample are the authors' familiarity with the structure of the retail sector in the AP Vojvodina market, knowledge of the issue of placements on the national market and availability of necessary data through the Serbian Business Registers Agency (SBRA).

In the context of *suggestions and recommendations for future research*, it is necessary to extend the sample to retailers headquartered in other regions of the national market and to compare it with similar results in the Western Balkans region, as well as to perform comparison between EU and non-EU countries. Final consumers' views should be included in the analysis and their views should be compared with retailers' views. Such research would further complement the scientific **contribution** in solving the problems of introducing intelligent packaging on the national market of the Republic of Serbia.

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References

Andrei, J. V., & Darvasi, D. (2012). Perspectives and challenges in financing the new Common Agricultural Policy, a new paradigm. *Journal of Food, Agriculture & Environment, 10*(1 part 2), 904-907. http://www.isfae.org/scientificjourna.

Bledsoe, G., & Rasco, B. (2018). Recent Advances on Intelligent and Active Packaging in Food and Beverage Technology. *Food Health and Technology Innovations*, *1*(2), 72-74. Available at: https://dergipark.org.tr/en/pub/food/issue/43053/521584

Cappelli, L., D'Ascenzo, F., Ruggieri, R., Rossetti, F., & Scalingi, A. (2019). The attitude of consumers towards Made in Italy products. An empirical analysis among Italian customers. *Management & Marketing – Challenges for the Knowledge Society, 14*(1), 31-47. https://doi.org/10.2478/mmcks-2019-0003

Dainelli, D., Gontard, N., Spyropoulos, D., Zondervan-van den Beuken, E., & Tobback, P. (2008). Active and intelligent food packaging: legal aspects and safety concerns. *Trends in Food Science & Technology*, *19*, 103-112. https://doi.org/10.1016/j.tifs.2008.09.011

Dobrucka, R. (2013). The future of active and intelligent packaging industry. *Logforum*, *9*(2), 103-110. Available at: http://www.logforum.net/pdf/9_2_4_13.pdf

Drăgoi, M. C., Andrei, J. V., Mieilă, M., Panait, M., Dobrotă, C. E., & Lădaru, R. G. (2018). Food safety and security in Romania–an econometric analysis in the context of national agricultural paradigm transformation. *Amfiteatru Economic, 20*(47), 134-150. https://www.ceeol.com/search/article-detail?id=678573

Fang, Z., Zhao, Y., Warner, R. D., & Johnson, S. K. (2017). Active and intelligent packaging in meat industry. *Trends in Food Science & Technology*, *61*, 60-71. https://doi.org/10.1016/j.tifs.2017.01.002

Fedorko, I., Bacik, R., & Gavurova, B. (2018). Technology acceptance model in e-commerce segment. *Management & Marketing – Challenges for the Knowledge Society,* 13(4), 1242-1256. https://doi.org/10.2478/mmcks-2018-0034

Foerster-Pastor (Foerster-Metz), U. S., & Golowko, N. (2018).The need for digital and soft skills in the Romanian business service industry. *Management & Marketing – Challenges for the Knowledge Society, 13*(1), 831-847. https://doi.org/10.2478/mmcks-2018-0008

Gerpott, T.J. (2018). Relative fixed Internet connection speed experiences as antecedents of customer satisfaction and loyalty: An empirical analysis of consumers in Germany. *Management & Marketing – Challenges for the Knowledge Society, 13*(4), 1150-1173. https://doi.org/10.2478/mmcks-2018-0029

Ghaani, M., Cozzolino, C. A., Castelli, G., & Farris, S. (2016). An overview of the intelligent packaging technologies in the food sector. *Trends in Food Science & Technology*, *51*, 1-11. https://doi.org/10.1016/j.tifs.2016.02.008

Jurjević, Ž., Bogićević, I., Đokić, D, & Matkovski, B. (2019). Information Technology as aFactor of Sustainable Development of Serbian Agriculture. *Strategic Management, 24*(1), 41-46. https://doi.org/10.5937/StraMan1901041J

Končar, J., Marić, R., & Vukmirović, G. (2018). Challenges of vertical integration of supply chains' members of food and organic products with domestic origin. *Anali Ekonomskog fakulteta u Subotici*, *54*(40), 149-169. https://doi.org/10.5937/AnEkSub1840149K

Končar, J., Grubor, A., Marić, R., Vukmirović, G., & Đokić, N. (2019). Possibilities to improve the image of food and organic products on the AP Vojvodina market by introducing a regional quality label. *Food and Feed Research, 46*(1). 111-124. https://doi.org/10.5937/FFR1901111K

Kocetkovs, V., Muizniece-Brasava, S., & Veipa, J. (2019). *Consumer awareness and attitudes towards active and intelligent packaging systems in the Latvian market*. Baltic Conference on Food Science and Technology: conference proceedings, LLU (pp. 222-226). http://doi.org/10.22616/FoodBalt.2019.025

Lovreta, S., Končar, J., Petković, G., Bogetić, Z., & Stojković, D. (2019) *Kanali marketinga*. Univerzitet u Beogradu, Ekonomski fakultet, Centar za izdavačku delatnost, Beograd.

Marić, R. (2019). Komercijalno poznavanje proizvoda. Subotica: Ekonomski fakultet u Subotici.

Ortego, I., Sanchez, N., Garcia, J., Casado, F., Valderas, D., & Sancho, J. I. (2012). Inkjet printed planar coil antenna analysis for NFC technology applications. *International Journal of Antennas and Propagation*, *2012,* 1-7. http://dx.doi.org/10.1155/2012/486565

Realini, C. E., & Marcos, B. (2014). Active and intelligent packaging systems for a modern society. *Meat science*, *98*(3), 404-419. https://doi.org/10.1016/j.meatsci.2014.06.031

Ruggieri, R., Savastano, M., Scalingi, A., Bala, D., & D'Ascenzo, F. (2018). The impact of Digital Platforms on Business Models: an empirical investigation on innovative start-ups. *Management & Marketing– Challenges for the Knowledge Society*, *13*(4),1210-

1225. https://doi.org/10.2478/mmcks-2018-0032

Prasad, P., & Kochhar, A. (2014). Active packaging in food industry: a review. *Journal of Environmental Science, Toxicology and Food Technology*, *8*(5), 1-7.

Rakić Sokolović, M., Ostojić, G., Lazarević, M, Stanovski, S. (2008) Applying RFID Technology in logistics. *Strategic Management, 13*(3), 36-43.

Rachmelia, D., & Imawan, C. (2018) Time Temperature Indicator Label using Black Corn Extract and Chitosan Matrix. *Journal of Physics: Conference Series, 1120*(1), 1-8. http://dx.doi.org/10.1088/1742-6596/1120/1/012041

Restuccia, D., Spizzirri, U. G., Parisi, O. I., Cirillo, G., Curcio, M., Iemma, F., ... & Picci, N. (2010). New EU regulation aspects and global market of active and intelligent packaging for food industry applications. *Food control*, *21*(11), 1425-1435. https://doi.org/10.1016/j.foodcont.2010.04.028

Shafiq, F. (2019). Impact Of Smart Packaging And Evaluating Its Understanding Effect Upon Consumer Motivation In The Fresh Food Items. *Journal of Marketing and Logistics (JML), 2*, 16-30. Available at: http://jml.kasbit.edu.pk/Volume/2/page%20no%2016-30.pdf

Vanderroost, M., Ragaert, P., Devlieghere, F., & De Meulenaer, B. (2014). Intelligent food packaging: The next generation. *Trends in Food Science & Technology*, *39*(1), 47-62. https://doi.org/10.1016/j.tifs.2014.06.009

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