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PREFACE

A Word from the Editor-in-Chief

Dear colleagues,

In your hands are the Proceedings of the 9th International Scientific Agricultural Symposium "AGROSYM 2018" held on 4-7 October 2018 in Jahorina, Bosnia and Herzegovina. The Symposium gathers about 1200 participants from 85 different countries and organizers received over 1200 abstracts/full papers. Symposium themes covered all branches of agriculture and were divided into seven sessions: 1) Plant production, 2) Plant protection and food safety, 3) Organic agriculture, 4) Environmental protection and natural resources management, 5) Animal husbandry 6) Forestry and Agro-forestry, and 7) Rural Development and Agro-economy.

In the plenary lectures was presented the importance of new information and communication technologies for agriculture in the 21st century and biological protection in plant production. Furthermore, a particular attention was devoted to avoiding knowledge waste through networking and partnership.
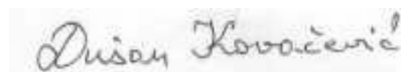
Agriculture has a complex relationship with natural resources and the environment, thus attributing specific environmental effects to agriculture is difficult and not fully understood. Today, it is obvious that conventional methods of agricultural production, in addition to providing sufficient food and other products, have led to a number of negative impacts, including direct or indirect effects on human health. Excessive use of agrochemicals can cause various disorders in the biological equilibrium of agroecosystems and beyond. These negative impacts raise serious questions about long-term sustainability of high-input agriculture. Measures to protect soil and water in agriculture include comprehensive and complex undertakings and pre-planned measures. These problems are a constant reason for 'popularisation' of all ecological trends in agriculture (e.g. organic agriculture, permaculture, biodynamic agriculture, conservation agriculture, regenerative agriculture, integrated farming, agroecology, etc.). Meanwhile, there are also calls for a genuine, deep transformation of agro-food systems that goes beyond 'ecologisation' of agricultural production. All these developments in agricultural research field, as well their implications on farmers' fields, were discussed during the 4 days of AGROSYM 2018.

All papers included in the Proceedings were peer-reviewed. Full texts of the accepted contributions are available in electronic form on AGROSYM website (http://agrosym.unssa.rs.ba).

I hope that the Proceedings will be useful to many agriculturalists and to those engaged in related fields and enable better collaboration of scientists, researchers and producers.

Many thanks to all the authors, reviewers, session moderators and colleagues for their help in editing the Proceedings "AGROSYM 2018". Special thanks go to all co-organizers for their unselfish collaboration and comprehensive support.

East Sarajevo, 07th October 2018

Prof. Dušan Kovačević, Editor-in-Chief

IMPACT OF KEY RESOURCES AND ATTRACTIONS ON COMPETITIVENESS OF RURAL DESTINATIONS IN SERBIA AND HUNGARY

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Abstract

All destinations are an amalgam of tourism products aimed at providing consumers with a unique, integrated tourism experience. Destination resources and attractions, as factors of tourist offer, represent real incentive force that creates a tourist demand. The aim of this paper was to explore how key resources and attractions – physical and geographic elements of the environment, cultural heritage, opportunities for sports, leisure and recreation, accommodation facilities and their authenticity, gastronomy, general infrastructure and tourism infrastructure, safety and security - affected competitiveness of rural tourism destinations in Serbia and Hungary. Tourism experts from Serbia (163) and Hungary (175) were asked to evaluate the current condition of 24 attributes affecting the competitiveness of rural tourism destination. Likert scale of five marks was used in order to determine the effect of key resources and attractions on the competitiveness of Serbia/Hungary as a rural tourism destination. The research showed that the rural tourism sector in both countries had plenty of natural resources and special attractions. However, the accompanying services and contents were very limited and this could affect the reduction of attractiveness, and therefore the ability of the sector to highlight its potential. In the absence of ancillary infrastructure and resources, possible outcomes for the destination can range from service delivery below the expectations of visitors to major failures, thereby preventing the long-term development of the destination. The three basic elements have the potential to increase the length of stay and tourist consumption, which are: folk tradition, gastronomy and opportunities for sports and recreational activities in nature.

Keywords: *key resources and attractions, rural destination, competitiveness, Serbia, Hungary.*

Introduction

Rural tourism is one of the priorities in the tourist development of many European countries. The rural tourism market is on the rise, while at the same time the future of many rural areas is uncertain, due to changes in agricultural production or the attractiveness of urban areas due to a higher standard of living. Rural tourism is considered as one of the appropriate instruments for the revitalization of rural areas and ensuring their sustainable future through job retention or job creation, support for agricultural holdings, preserving nature, or preserving rural crafts as a tourist attraction. Destinations of rural tourism are based on a complex tourist product consisting of several partial products (accommodation, transport, food, trade, attractions, etc.) and offered as such to visitors (Roberts, Hall, Mitchell, 2003; Demonja, Ružić, 2010; Sidali, 2011). These individual tourism companies are interdependent and interconnected, and these are primarily small and medium-sized enterprises that carry the activity. Problems in rural tourism that contribute to the reduction of competitiveness are reflected through the existence of strong competition instead of cooperation among providers of tourism products and services in rural areas. Considering the importance of tourism for

rural areas, determining the factors that influence the improvement of the competitive position in the tourism market is of great importance for their further development.

Key resources and attractions – theoretical framework

All destinations are an amalgam of tourism products aimed to provide consumers with a unique, integrated tourism experience. Tourist destination products include a range of facilities and services offered at the local level, along with all socio-cultural, natural resources and public goods (Buhalis, 2000). Dwyer and Kim (2003) suggested that tourism resources and attractions should be the basis of destination competitiveness. An analysis of previous research on the attribute of the tourist destination (Buhalis, 2000; Kim, 1998) clearly indicated a wide range of attributes adopted by researchers to determine the attractiveness of tourist destinations, although some attributes are common for many research (e.g. climate, landscape, activities, accessibility). A review of literature (Seddighi, Theocharous, 2002; Navarro, 2015) found that there is no universal set of tourist attractions and resources to determine the attractiveness of a tourist destination or its competitiveness. For the purposes of this paper, the basic resources and attractions identified in the Crouch-Ritchie competitiveness model have been selected with the exception of links to emitting markets, as these elements are in line with the main research of destination attractiveness. The factor "Safety and security" was added to the group of key resources and attractions of the destination. Consequently, the "Key Resources and Attractions" is comprised of seven main factors:

1. *Physical and geographic elements of the environment* - Natural attractiveness consists of physical and geographical elements of the environment, important for rural tourism: relief, climate, hydrographic elements, plant and animal world, protected natural areas and nature parks. Especially interesting are the areas that have certain forms of relief from horizontal and vertical diversity. The climate impact is reflected in the stimulation of the development of certain forms of tourism, for example, the mountain with many snowfalls for winter, ski tourism. The flora and fauna are also important factors that attract and direct tourists to specific areas. And the animal species that are kept in some areas, increase its tourist appeal. The richness of wildlife in the forests and fish in the waters not only beautifies and makes the area interesting, but also provides opportunities for the development of various touristic contents such as hunting and fishing, observing birds, exploring, taking pictures, taking care of their maintenance and other activities.

2. *Cultural heritage* - Many cultural heritage resources, either material or non-material, include unique features that reflect their history, lifestyle or the environment, and are ideal to become tourist attractions (McKercher, Ho, du Cros, 2004). Rural culture has been, and is still, determined by specificities that help in shaping rural life style and society. Architectural heritage provides a rich source of evidence of rural culture, as well as their aesthetic values - rural houses and supporting structures reflect a way of life and a local history that has contributed to the creation of rural culture through centuries. Music, play and theater performances as part of narration can form the basis of rural social life. Religious festivals and pilgrimages are most often conducted in rural areas. The rural regions of Europe have a strong local identity, unknown to urban areas. The rich heritage of tradition and customs transmitted through centuries has a value that is valued across the continent.

3. *Opportunities for sports, leisure and recreation* - This group includes those types of attractions that are not directly related to natural or cultural characteristics and "artificial" are created, which are recreational activities and manifestations and festivals. In rural tourism, there are frequent combinations of sports and recreational activities and tourism. In this regard, they differ: (1) breaks with elements of sporting content and (2) business trips with elements of sporting content. In both of these sectors, sporting participation can be either active or passive. The most important, recreational and tourist

activities in a large number of rural environments have dramatically transformed from relatively passive to active and very important factors of natural, economic and social change.

4. *Accommodation facilities and their authenticity* - It is considered that a tourist destination with built accommodation capacities is not limited to day-tourists, but can attract visitors who will stay there for a long time (Kelly, Nankervis, 2001). In order for a tourist destination to be successful, the accommodation facilities must be available in sufficient numbers and meet the needs of the coming tourists. Apart from the adequate quality and quantity of accommodation capacities, the concept of authenticity is of great importance in rural tourism, and is intensively applied in the catering sector. The authenticity of the accommodation object is related to the material used in the construction, the architectural style, the attitude towards the environment and the appearance of the interior.

5. *Gastronomy* - Many actors in tourism (e.g. hotels, restaurants, local communities) have understood the importance of gastronomy as a driving force for tourists on one hand, and for, stimulating local, regional and national economic development on the other. Planning and conceiving of additional tourist facilities in rural areas should emphasize some functions of rural settlements, taking into account everyday activities and lifestyles of the local population. One of these activities is food preparation, i.e. local specialties, respecting the authenticity, as well as the protocol of hospitality. Gastronomy with its activities can be of great help in creating the content of the stay. These activities can be daily as: participation in the preparation of food; preparation and production of bread in a rural way; baking brandy in the night; preparing cheese and for the market, and more.

6. General infrastructure and tourism infrastructure - Infrastructure development is one of the important segments of rural policy. Well-developed infrastructure is considered to be one of the most important prerequisites for rural and overall economic development. Developed infrastructure contributes to: the economic aspect of the lives of rural communities by reducing regional inequalities and improving access to the market and, consequently, lower transport and transaction costs, increased trade exchange with other regions, and an increase in rural household income. The volume of investments in rural areas, as well as the volume of revenues from other non-agricultural branches of rural economy, such as tourism, is increasing. Lack or inadequate infrastructure (e.g. lack of tourist signaling) can diminish the atmosphere of tourists at the destination. Infrastructure is basic element in the tourism development of rural areas, so building, equipping, improving and upgrading infra and substructures should be a permanent stategic goal.

7. *Safety and security* - Safety and security are the primary condition for a successful tourist destination. To make tourists feel safe and secure before and during travel is essential for the competitiveness of tourist destinations. Negative impressions of a destination can cause a decline in tourist traffic even if the destination has high-quality tourist attractions (George, 2003). As in any other business activity, as well as rural tourism or agri-tourism, there are certain risks that must be faced by those who want to deal with this business. Risks in agritourism can be found in both the service provider and the tourists who use these services. For example, tourists who come to farm can accidentally be infected by some plant or animal diseases or, on the other hand, tourists can be the cause of death of animals or plants. In order to minimize risks, many farms create galleries from which a production process can be observed without direct contact. Risk is also growing due to conscious (deliberate) and unconscious (unintentional) tourist activities.

Materials, method and the targets of the paper

The aim of this paper is to examine the impact of key resources and attractions on competitiveness of rural destination. The authors analyzed views of stakeholders important for the development of rural tourism on the supply side in Serbia and Hungary (direct

providers of services in rural tourism, employees in tourist organizations and tourist agencies, employees in municipal and provincial services, employed in ministries, teaching staff at faculties). Tourism experts from Serbia and Hungary were asked to assess the current state of seven factors which affect/could affect the competitiveness of rural tourism destinations in Serbia/Hungary. Likert scale of five scores was used, where 1 means "very bad condition of the factor", 2="bad condition", 3="average condition", 4="very well" and 5="excellent condition of the factor". In this paper, survey research covered all those tourism experts who have the knowledge and/or experience relevant to the subject, and whose area of research and action is related to rural tourism and competitiveness of tourist destinations. In Serbia (163 experts) and Hungary (175 experts), interviewed tourism experts are as follows: teaching staff at higher education institutions, employees of the tourist organizations, employees of national and provincial institutions of importance for the development of tourism, tourism managers of travel agencies, owners of tourism enterprises in rural areas (farms, restaurants, ethno-houses, museums, wineries, souvenir shops, event organizers) and others (societies, associations, clusters). The survey was conducted in two ways - a personal interview (technique of "face to face") and by sending a questionnaire via e-mail. Selected tourism experts in Serbia and Hungary were interviewed in the period from March to May 2017. The response rate in both countries is about 60%. Statistical analysis of the data collected through the survey was done in the software statistical program SPSS 20.

Results and discussion

Table 1 presents the differences on the first scale for factors that belong to the determinants "Key resources and attractions" (arithmetic mean, standard deviation, value, and significance). At the significance level $p<0.01$, statistically significant differences were achieved with the factor "Physical and geographic elements of the environment", "Accommodation capacities and their authenticity" and "General infrastructure and tourist infrastructure".

Table 1. T-test for dependent samples - comparison of the results between Serbia and Hungary for the determinant "Key resources and attractions"

Factor	Country	Arithmetic mean	Standard deviation	Value	Significance
Physical and geographic elements of the environment	Serbia	3.5001	.55830	-7.422	.000
	Hungary	4.0058	.56773		
Cultural heritage	Serbia	3.5257	.66477	-2.184	.030
	Hungary	3.7099	.72649		
Opportunities for sports, leisure and recreation	Serbia	3.7426	.73783	-2.535	.012
	Hungary	3.9562	.65157		
Accommodation facilities and their authenticity	Serbia	3.0931	.65256	-7.602	.000
	Hungary	3.6788	.62021		
Gastronomy	Serbia	3.9669	.83267	-.002	.998
	Hungary	3.9672	.90180		
General infrastructure and tourism infrastructure	Serbia	2.9326	.70196	-9.736	.000
	Hungary	3.7117	.61785		
Safety and security	Serbia	4.0478	.75738	1.342	.181
	Hungary	3.9192	.81852		

The obtained results for factors in which there is a statistically significant difference show that the use of rivers, lakes and channels in rural tourism in Hungary is much more intensive and organized than in Serbia, and protected nature areas and nature parks are more represented in the rural tourism offer, that is, a large number of organized programs involving natural areas, as well as a series of activities organized in these areas. Also, there is a significant difference in the factor "Accommodation capacities and their authenticity", especially the difference in

the average ratings expressed between Hungary and Serbia when it comes to the authenticity of accommodation units. The tourist offers, that is, the owners of accommodation facilities in Hungary, take care that the different contents and the appearance of the building increase the attractiveness of the building. The condition, that is, the quality of basic infrastructure in Hungarian villages is better than in Serbian, while the differences between the quality of basic infrastructure in agritourism facilities is not so pronounced. In Figure 1, Serbia is the closest, according to results, in terms of gastronomy, opportunities for sport, entertainment and recreation in rural areas and cultural heritage. This is not surprising, since once part of Serbia (Vojvodina province) and Hungary share a part of history, and that a significant number of Hungarians live in the territory of Vojvodina nurturing their culture and tradition. It is interesting that the only factor of the model that has a higher average rating in Serbia than in Hungary is "Safety and security". In further research, it is necessary to examine for what reasons the safety and security in Hungary is estimated lower than in Serbia, and this advantage can be used for participation in the Hungarian rural market and for attracting their tourists.
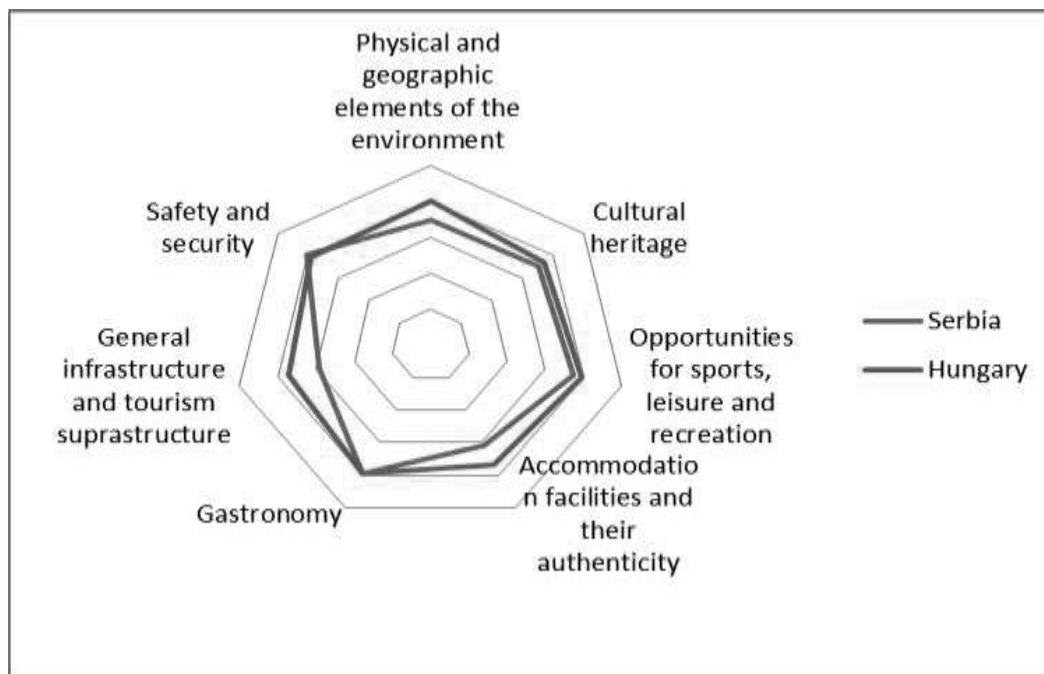
Figure 1. Performance of Serbia and Hungary for factors within the determinant "Key resources and attractions"

Conclusion

The strategy for the development of rural tourism in Serbia should have a special connection with the resources and attractions of the destination, while the priority should be given to maintaining all aspects of security and safety, the continuous improvement of services, the benefits of multicultural environment, the diversity of gastronomic products and the application of the principles of sustainability in environmental management. It is increasingly important to recognize and accept the need for resources to be managed in a sustainable way in order to be preserved for future generations. The rural tourism sector in Serbia has plenty of natural resources and special attractions. However, the accompanying services and content are very limited and this can affect the reduction of attractiveness, and therefore the ability of the sector to highlight its potential. In the absence of ancillary infrastructure and resources, possible outcomes for the destination can range from service delivery below the expectations of visitors to major failures, thereby preventing the long-term development of the destination.

The three basic elements have the potential to increase the length of stay and tourist consumption, which are folk tradition, gastronomy and opportunities for sports and recreational activities in nature. Developing key elements can stimulate visitors of rural areas of Serbia to stay longer, spend more money and participate in a wider range of activities.

The most important competitors to Serbia as a destination for rural tourism are Hungary, Croatia and Slovenia (and increasingly Romania). By comparing the results of the survey between Serbia and Hungary, it can be concluded that the level of rural tourism development in Hungary is significantly higher than in Serbia, since there is a statistically significant difference in the assessment of almost all factors (apart from factor "safety and security"). Tourism experts of Hungary do not see Serbia as their competitor, which leads to the conclusion that tourism policy holders should look at Hungary as a market that requires greater investment and significant efforts to meet the demands of their sophisticated rural tourists, which can not happen in a short period of time. In the future, Hungary should be seen as a partner and Serbian stakeholders should develop joint projects with their stakeholders, which will increase the quality of the supply of rural tourism in Serbia. At this moment, the Hungarian rural tourism market should be seen as an example of good practice. In the meantime, attention and efforts should be directed towards foreign tourist markets with a possible entry into the countries that Serbia has good traditional connections (Montenegro, Bosnia and Herzegovina, Greece, Russia).

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POTATO PRODUCTION CHARACTERISTICS – COMPARATIVE ANALYSIS: SERBIA, MACEDONIA AND ENTITY OF REPUBLIC OF SRPSKA (BOSNIA AND HERZEGOVINA)

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Abstract

The parameters of potato production in Serbia, Macedonia and Entity of Republic of Srpska (Bosnia and Herzegovina) were analysed in the period 2005-16. Sown areas, yields and total production were analysed. Quantitative analysis was performed by using descriptive statistics method, and we used average annual rate of changes to discover the tendencies of changes in the analysed period. In Serbia, there were 63,646 hectares of potato in average, in Macedonia 13,402 hectares and in Republic of Srpska 14,858 hectares. Serbia showed a trend of decreasing areas of potato with average rate of -3.38% per annum, Macedonia had tendency of increasing area by the annual rate of 2.45%, and Republic of Srpska also decreased areas of potato by average yearly rate of -2%. The average potato yield was 13.4 tons per hectare in Serbia, with variation coefficient of 29.8%, in Macedonia, 13.9 t/ha (variation coefficient 6.8%) and in Republic of Srpska 11.2 t/ha (variation coefficient 12.8%). In the observed period, there was a growth tendency in yields: 0.64 in Serbia, 2.30 in Macedonia and 1.31 percent per year in Republic of Srpska. The average annual potato production in Serbia was 803,669 tons (variation coefficient of 18.1%), in Macedonia 186,770 tons (variation coefficient of 6.2%) and 166,221 tons in Republic of Srpska, (variation coefficient of 14.9%). Potato production showed tendency of growth in Macedonia, 4.79%, while it decreased in Serbia, -2.74 and in Republic of Srpska -0.72 percent per year in average.

Key words: *potato, production, Serbia, Macedonia, Republic of Srpska.*

Introduction

Truck farming represents a significant area of crop production for the agriculture in Serbia, Macedonia and Republika Srpska. The main characteristics of olericulture are:
- relatively short production process, which enables two or more crops in a year, and consequently better land use
- intensive production – large investments into irrigation and technology resulting in higher yields
- the need for manure activates cattle breading
- high level of economic effectivity as measured with the value of production and profit per hectare

The object of exploration in this paper is comparative analysis of performances of potato production in Serbia, Macedonia and Republika Srpska. Analysis of potato area harvested, potato yield per hectare and total production is performed for the period of 12 years, i.e. from 2005 to 2016. The aim of investigation is to compare yields, production of potato and its share in total crop production, and tendencies of these indicators in the analyzed countries. From comparative analysis, we can derive conclusions about the importance of potato production and positive/negative tendencies in the analyzed period; our investigation will reveal factors of these movements. The authors of this paper have been recently dealing with this problem.

Novkovic et al. (2008) analyzed vegetable production in Serbia and Vojvodina between 1981 and 2007. They found that the vegetable area is less than 300,000 hectares in Serbia. This includes 80,000 hectares in Vojvodina. In Serbia vegetables are produced on around 8.5% of total arable land, so Vojvodina lags with its 5%. On the other hand, areas under vegetables are stable, with slow tendency of growth in Serbia and decline in Vojvodina. Mutavdzic et al. (2011) analyzed the results of vegetable production in Serbia in the period 2001-2010, and these results were compared with those obtained for the previous decade (1991-2000). During these years, the production of every vegetable type increased: garlic for 2%, red pepper for over 26%, green peas for around 56%. Novkovic et al (2011) analyzed changes in sown areas, yield and total production of several important vegetable types in Vojvodina in the period 2000-2009. Due to increased yields per hectare, the total production increased, despite reductions in the total sown area. Novkovic et al. (2012) obtained similar findings about vegetable production in Republika Srpska. A great number of author has published findings concerning analyses and forecasts of production of different types of vegetables (Novkovic et al., 2012a, 2013, 2014, 2014a, 2015, 2016; Илин et al. 2014; Ivanisevic et al. 2015; Miljanovic et al. 2014; Mutavdzic et al. 2013, 2016).

Material and Methods

Quantitative explorative methods were used in this paper. Quantitative analysis included data on sown areas, yields and total potato production in Serbia, Macedonia and Republika Srpska in the period 2015-2016. The next statistics were calculated: arithmetic mean – average ($\overline{X}$) and rate of change (r).

Given the values of a time series Y with length n, the average index of change is:

$$G = \left(\frac{Y_n}{Y_1} \right)^{\frac{1}{n-1}}$$

and the average rate of change:

$$r = (G - 1)$$

where

r is the average annual rate of change

G is the average annual index of change

Y_1 is the absolute value of the first member of the time series

Y_n is the value of the last number of the time series

n is the length of the series (number of years)

Data published by official statistical bureaus of Serbia, Macedonia and Republika Srpska were used in our analyses. At first, analysis of individual data about potato-production was completed, and that was followed by comparative analysis between the Republics. Comparison was performed using the index-method; when the observed changes had opposite directions between Republics, a qualitative comparative analysis was done instead of calculation of indices.

Results and Discussion

Table 1 displays performances of potato production in Serbia. Data show that there are negative tendencies in areas under potato but on the contrary, yields were growing, which results in slower decreasing of annual production. High value of variation coefficient indicates there were serious influences of factors from nature on average yields and production. Variations in sown area are less, but still high, and this point out the fact that economic and market risks are present in this kind of production.

Table 1. *Basic data on potato production in Serbia, 2005-2016*

Production indicators	Average	Interval of variation		Variation coefficient (%)	Average rate of change (%)
		Minimum	Maximum		
Area (ha)	66,646	40,105	93,897	29.8	-3.38
Production (t)	803,669	577,966	1,015,017	18.1	-2.74
Yield (t/ha)	13.4	6.6	17.8	25.7	0.64

In Table 2, basic characteristics of potato production in Macedonia are shown. Average rates of changes are positive and similar for areas and yields, resulting in progressive tendencies in total production. Stability of potato area in Macedonia is confirmed by the fact the corresponding variation coefficient is relatively low. The variation coefficient for yields is higher but still low, showing that there is some influence of natural factors and production conditions, and in the same time, the production is intensive, meaning that external factors are well controlled.

Table 2. *Basic data on potato production in Macedonia, 2005-2016*

Production indicators	Average	Interval of variation		Variation coefficient (%)	Average rate of change (%)
		Minimum	Minimum		
Area (ha)	13,402	12,926	13,829	1.9	2.45
Production (t)	186,770	165,975	204,778	6.2	4.79
Yield (t/ha)	13.9	12.1	15.4	6.8	2.30

The results of descriptive statistics of performances of potato production in Republika Srpska are presented in table 3. There are negative tendencies in changes of potato area. Nevertheless since the yields are enlarged, decreasing in total production is lessen, the fall is minimal, with the rate of under 1% in average. The variation coefficients of the area, yields and total production are somewhere between data for lower Macedonia and higher Serbia.

Table 3. *Basic data on potato production in Republika Srpska, 2005-2016*

Production indicators	Average	Interval of variation		Variation coefficient (%)	Average rate of change (%)
		Minimum	Maximum		
Area (ha)	14,858	13,284	16,886	8.8	-2.00
Production (t)	166,221	124,144	208,447	14.9	-0.72
Yield (t/ha)	11.2	8.2	14.2	12.8	1,31

The results of comparative analysis of potato area are shown in Table 4. The largest potato area was sown in Serbia, almost five times as much as in Macedonia, and four and a half times as in Republika Srpska. Total area was decreasing in Serbia and Republika Srpska, but increasing in Macedonia.

Table 4. *Average potato area in Serbia, Macedonia and Republika Srpska 2005-2016*

Indicator	Republic			Index Macedonia = 100	
	Serbia	Macedonia	R. Srpska	Serbia	R. Srpska
Average area (ha)	66,646	13,402	14,858	497	111
Rate of change (%)	-3.38	2.45	-2.00	-	-

Average potato yield and the results of the comparative analysis are given in Table 5. In every republic, yields had growing tendencies. The largest average yield was achieved in Macedonia, while in Serbia it was for 4% lower and in Republika Srpska for 19% lower. The average growth rate of potato average yield was highest in Macedonia, and that exceeded growth rate in Serbia 3.6 times and in Republika Srpska for 75%.

Table 5. Average potato yield in Serbia, Macedonia and Republika Srpska, 2005-2016

Indicator	Republic			Index Macedonia = 100	
	Serbia	Macedonia	R. Srpska	Serbia	R. Srpska
Average yield (t/ha)	13.4	13.9	11.2	96	81
Rate of change (%)	0.64	2.30	1,31	28	57

Table 6 contains results of comparative analysis of average annual potato production. Serbia had the largest average annual potato production, which amounted to 160 thousand tons of potato per year. This quantity is 4.3 times as much as in Macedonia and 4.8 times as much as in Republika Srpska. In the same period, Serbia and Republika Srpska had negative average rates of changes of potato production, while the rate was positive in Macedonia.

Table 6. Average annual potato production in Serbia, Macedonia and Republika Srpska 2005-2016

Indicator	Republic			Index Macedonia = 100%	
	Serbia	Macedonia	R. Srpska	Serbia	R. Srpska
Average annual production (t)	803,669	186,770	166,221	430	89
Rate of change (%)	-2.74	4.79	-0.72	-	-

We can get a better insight into the importance of potato production for a country through analysis of production per capita. Results of comparative analysis of potato production per capita are shown in Table 7. The largest potato production per inhabitant had R. Srpska, the next is Serbia with 24% less production p.c. and Macedonia with 36% less production p.c.

Table 7. Average annual potato production per capita, 2005-2016

Indicator	Republic			Index Macedonia = 100%	
	Serbia	Macedonia	R. Srpska	Serbia	R. Srpska
Average annual production/Number of inhabitants (kg/p.c.)	111.8	90.9	141.6	123	158
Number of inhabitants in thousands (2011 census)	7,186	2,054	1,174	349,9	57,2

Conclusions

The results of comparative analysis of potato production in Serbia, Macedonia and Republika Srpska in the period 2005-2016 were as follows:

- The average potato area was 63,646 ha in Serbia (variation coefficient 29.8%), 13,402 ha in Macedonia (variation coefficient 1.9%) and 14,858 ha in Republika Srpska (variation coefficient 8.8%)
- The average annual rate of decline of potato area in Serbia is 3.38%, average annual rate of growth is 2.45% in Macedonia, and average annual rate of decline in Republika Srpska is 2%.
- The largest average potato yield per hectare was achieved in Macedonia with 13.9 t/ha, that was followed by Serbia with 13.4 t/ha and Republika Srpska with 11.2 t/ha.
- The greatest value of rate of growth of average potato yield was in Macedonia with 2.3%, than Republika Srpska with 1.31% and Serbia with 0.64%.
- Serbia has the largest total potato production per year (800,000 tons), the next are Macedonia (190,000 tons) and Republika Srpska (170,000 tons).
- Macedonia has the only positive rate of change of potato production (average annual rate of growth is 4.79%), while there is decline in Republika Srpska (-0.72%) and Serbia (-2.74%).
- Republika Srpska has the highest position among the three republics concerning potato production per inhabitant (142 kg p.c.), then follows Serbia (112 kg p.c.) and Macedonia (91 kg p.c.).

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CARBON DIOXIDE EMISSIONS IN RETAIL FOOD

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Abstract

Increased attention has been paid recently to the analysis of the effects of applying the concept of sustainable development in retail. In that context we have particularly considered greenhouse gases emission in retail food. This is achieved through the use of modern ecological technology in business – through the whole food value chain. The ultimate goal is to achieve the planned reductions of carbon dioxide in retail food, which positively reflects the overall performance of retailers food, environmental in particular. The costs of carbon dioxide emission reduction affect the performance of retailers food. Continuous empirical research shows that almost all global retailers food achieve a significant reduction in carbon dioxide emissions from year to year. Empirical research conducted in this paper on the example of global retailers food in the United States, Europe and the European Union, the United Kingdom, and Serbia shows significant and planned reduction of carbon dioxide emissions in retail food, especially in countries with developed market economies. This empirical research is mainly based on the analysis of the original sustainable (environmental and ecological) reports officially disclosed by selected retailers food, primarily from the countries of a developed market economies, which they started to publish with regular annual financial statements. They are now an integral part of the so-called integrated reporting on performance of global retailers food. Due to the general importance, harmonized regulations on sustainable retail food reporting are being increasingly applied as a data source for more efficient environmental management. In perspective, this will ease the comparative analysis of the carbon dioxide emission of global and other retailers food. (*Jel Classification: I10, L81, M14, M41, Q42, Q56, Q57*)

Key words: *greenhouse gas emissions, carbon dioxide, CO_2 emission sources, renewable energy sources, sustainable reporting*

Introduction

The overall goal of global retailers food is to reduce carbon dioxide emissions through the entire food value chain. The subject of research in this paper is the significance and trend of carbon dioxide emissions in retail food. The costs of carbon dioxide emission reduction are significant and affect the performance of retailers food. The problem of comprehensiveness of the research on carbon dioxide emissions in retail food is that, at the time being, there is no unified system of sustainable (environmental) reporting for all retailers. In addition, many retailers food still do not publish this report, what as a consequence, has an incomplete "comparability" of data on carbon dioxide emissions by individual retailers food. Nevertheless, knowledge of the importance and trend of carbon dioxide emissions from global retailers food is very important in order to manage overall, integrated and, in particular, environmental performance in (concrete) retail food. In view of the global, other retailers food will increasingly publish reports on sustainable development (with data on carbon dioxide emissions). In this way, they will increase its information base for more efficient management of total business, including environmental protection. This will have a positive impact on the achievement of the target profit. This paper attempts to make thorough analysis of specific issues of carbon dioxide emissions in the retail sector, firstly on the example of global

retailers food from different countries, primarily developed market economies, which, due to the general importance of the matter, publish reports on sustainable development with regular annual financial reports. This practice of global retailers food provides them with more reliable information base for efficient management of carbon dioxide emissions through the whole value chain.

Material and Methods

There is voluminous literature devoted to analyzing the way company's performance is affected by general problems and effects of carbon dioxide emission reduction through the whole food chain (Kahn, 2014; Congcong, 2016; Li, 2016; Clune, 2017; Wang et al., 2017; Ji, 2017; Linda, 2014; Eriksson, 2017; Lukic, 2013, 2014, 2016, 2017; Lukic et al., 2018). The general research hypothesis in this paper is that the reduction of carbon dioxide emissions positively reflects on overall (integrated, especially environmental) performance of retailers food. The methodology of the study of the given hypothesis is primarily based on the comparative analysis of the carbon dioxide emission of global selected retailers food from various comparable countries of the developed market economy.

Main data sources for the research of the treated problem in this paper are literature, articles, and, in particular, officially disclosed annual financial and sustainable reports of global retailers food. They were processed in such a way that is easy to comprehend the significance and trend of carbon dioxide emission in retail food.

Results and Discussion

The carbon dioxide emission through the entire food value chain is shown in Table 1.

Table 1. Emissions of carbon dioxide through the life cycle of food after farm

Life cycle stage post-farm gate	Number of GWP (global warming potential) values	Median (kgCO$_2$-eq/kg)	Mean (kgCO$_2$-eq/kg)	Stdev	Min (kgCO$_2$-eq/kg)	Max (kgCO$_2$-eq/kg)
Processing meats	5	0,59	0,66	0,14	0,54	0,87
Processing vegetables	15	0,06	0,07	0,04	0,01	0,013
Packaging	8	0,05	0,06	0,06	0,01	0,21
Transport to RDC (Regional Distribution Centre	21	0,09	0,13	0,19	0,02	0,95
Retail	20	0,04	0,10	0,25	0,01	1.14

Note: The table is compiled on the basis of various relevant studies.
Source: Clune et al., (2017)

The data in the given table show that, on average, emission of carbon dioxide is higher in the processing of meat than vegetables. It is also higher in transport than in retail, and is the lowest in the packaging phase. This is in line with the nature of the activities concerned. Figure 1 shows sources of carbon dioxide emission throughout the value chain, with an emphasis on Tesco's participation in carbon footprint.
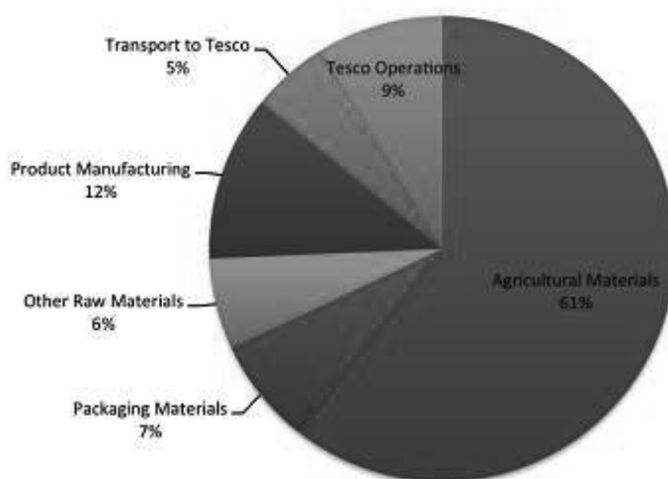
Figure 1. Emissions of carbon dioxide by source in Tesco

Source: Tesco - Our Carbon Footprint, https://www.tescoplc.com/tesco-and-society/sourcing-great-products/reducing-our-impact-on-the-environment/our-carbon-footprint/ (May 24, 2017)

Different is the carbon dioxide emissions of individual retailers food. This is shown by the results of the research in this paper.

At **Wal-Mart** (United States of America, Dominant operational format: Hypermarket / Supercenter / Superstore), a great significance is given to reducing carbon dioxide emissions (Table 2). This is achieved by: investing in renewable energy sources, reducing energy demand, improving energy efficiency, improving refrigeration in stores and maximizing the efficiency of the vehicle fleet.

Table 2. Carbon dioxide emission (Scope 1 and 2) and retail area at Wal-Mart, 2005-2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Carbon dioxide emission (million ton CO_{2e})	18,9	19,3	20,1	20,8	20,3	20,6	20,8	21,2	21,0	21,9
Retail area (million square meters)	740	805	867	921	952	985	1,037	1,072	1,102	1,134
Carbon dioxide intensity (million tons CO_{2e}/million m^2)*	0,025	0,024	0,023	0,022	0,021	0,021	0,020	0,020	0,019	0,019

Note: *Calculations performed by the author
Source: Wal-Mart Stores, Inc. 2016 Global Responsibility Report, https://cdn.corporate.walmart.com/9c/73/3f9abcef444397f2c771e081e095/2016-global-responsibility-report.pdf#page=58&zoom=auto,-130,628 (May 5, 2017)

In generating greenhouse gas emissions, Wal-Mart participates with: electricity supply 69%, refrigeration 18%, fuel transport 5.9%, fuel on the site 7% and mobile refrigerators with 0.1 % (Wal-Mart Stores, Inc. 2016 Global Responsibility Report, https://cdn.corporate.walmart.com/9c/73/3f9abcef444397f2c771e081e095/2016-global-responsibility-report.pdf#page=58&zoom=auto,-130,628 (May 5, 2017). Therefore, the main source of greenhouse gas emissions in Wal-Mart is electricity supply. With the increased application of the

ecological operation principles, Wal-Mart reduced carbon dioxide emissions from year to year, which reflects favourably on its overall performance, especially environmental.

At **Tesco** (United Kingdom, Dominant operational format: Hypermarket / Supercenter / Superstore), as with Wal-Mart, considerable attention is paid to the research and control of carbon dioxide emissions. This positively reflects on its overall performance, including the surrounding ones. In Figure 2, an illustration of the specificity of carbon dioxide emissions measurement at Tesco is shown.
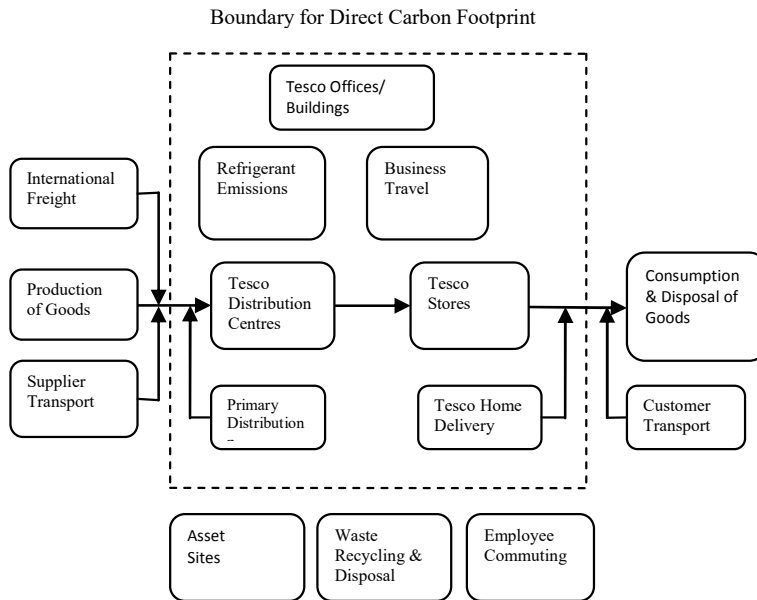
Figure 2. Tesco's emission limit

Source: Carbon Footprint 101: A Guide for Food Retailers,
https://www.fmi.org/docs/sustainability/carbon-footprint-101-a-guide-for-food-retailers.pdf?sfvrsn=4#page=11&zoom=auto,-121.85 (May 10, 2017)

Therefore, Tesco participated in total emission of carbon dioxide through entire value chain with 9%. Table 3 shows ecological performances at Tesco.

Table 3. Global ecological performances at Tesco

	2016/17	2015/16	2014/15	2013/14
Carbon dioxide (million ton CO_{2e})	3,9	5,1	5,26	-
Emission of CO_2 reduction (stores and distributional centres) compared to 2006/07	40,5%	39,5%	38,3%	-
Emission of CO_2 reduction (distribution) compared to 2011/12	19,7%	17.4%	14,47%	7,8%
Direct water consumption (million m^3)	23,5	25,5	32,6	32,9

Waste percentage (food and non-food) which is recycled, used again or turn into energy	93%	88%	84%	86%

Source: Reducing our impact on the environment,
https://www.tescoplc.com/tesco-and-society/sourcing-great-products/reducing-our-impact-on-the-environment/
(May 3, 2017)

The data in the given table show that the intensity of carbon dioxide emissions in Tesco is decreasing from year to year. Tesco has tendency to improve ecological performances (carbon dioxide emission reduction, direct water consumption reduction and waste treatment improvement). This reflects favourably on its market, economic and financial performances.

At **Ahold** (Germany, Dominant operational format: Supermarket), considerable attention is paid to the reduction of carbon dioxide emissions. This is shown in Table 4.

Table 4. Carbon dioxide emission at Ahold

	2008	2009	2010	2011	2012	2013	2014	2015
Carbon dioxide emissions (thousand tons)				2,176	2,106	2,107	2,090	2,019
Carbon dioxide emissions (kg CO_2/m^2 sales area)	567	574	543	507	480	473	465	420
Sources (%)								
Electricity								49%
Refrigerant appliances								29%
Fuel								12%
Gas								10%

Source: Ahold - Responsible Retailing Report 2015,
https://www.aholddelhaize.com/media/1934/ahold-responsible-retailing-report-2015.pdf (May 9, 2017)

Carbon dioxide emissions at Ahold has been decreasing year after year. Since 2016, Ahold has been operating under the name of Ahold Delhaize. In view of this, Table 5 shows data on carbon dioxide emissions for Ahold Delhaize (Belgium, Dominant operational format: Supermarket) in 2016.

Table 5. Carbon dioxide emission at Ahold Delhaize

	2016 Actual	2020 Target
% reduction in CO_2 equivalent emissions per m^2 of sales area (from 2008 baseline)	-22%	-30%
Total CO_2 equivalent emissions per m^2 of sales area − location-based approach	496	n/a
Total CO_2 equivalent emissions (thousand tonnes) − location-based approach	4,505	n/a
Total Scope 1 CO_2 equivalent emissions (thousand tonnes) − location-based approach	1,940	n/a

Total Scope 2 CO_2 equivalent emissions (thousand tonnes) – location-based approach	2,420	n/a
Total Scope 3 CO_2 equivalent emissions (thousand tonnes) – location-based approach	144	n/a
Offset CO_2 equivalent emissions (thousand tonnes)	241	n/a
Avoided grid electricity CO_2 emissions (thousand tonnes)	31	n/a

Source: Ahold Delhaize Supplementary report on Sustainable Retailing performance 2016, https://www.aholddelhaize.com/media/3984/supplementary-report-on-sustainable-retailing-performance-2016.pdf (May 9, 2017)

Significant reduction in carbon dioxide emissions by 2020 (30%) is expected at Ahold Delhaize. This will be achieved by using so-called "green energy" in business operations. Sources of carbon dioxide emissions were: electricity 60%, cooling devices 31% and transport 9% (Ahold Delhaize Supplementary Report on Sustainable Retailing performance 2016, https://www.aholddelhaize.com/media/3984/supplementary-report-on -sustainable-retailing-performance-2016.pdf (May 9, 2017). Delhaize Serbia is also part of Ahold Delhaize which employs the same sustainable development strategy and environment reporting as well as company at its higher organizational level.

Conclusions

A growing number of retailers (food) in the world are increasingly publishing reports on sustainable development. By their reputation, and because of its importance, other retailers will certainly tend to publish this report in the future. It provides the basis for a comparative analysis of environmental performance in retail food from various aspects. In this report, special significance is given to trend of greenhouse gas emissions, in particular, carbon dioxide. Carbon dioxide emissions in trade, in total and by sectors, vary by country. It is significantly higher in China than in Europe or the European Union. Likewise, carbon dioxide emissions are significantly higher in trade of France, Germany and Great Britain than in Greece, Croatia, Turkey and Serbia. Carbon dioxide emissions are higher in Croatia's trade than in Serbian. These differences are due to the application of various ecological measures in business.Carbon dioxide emissions differ in individual stages of the product life cycle, retail companies and product categories. Carbon dioxide emission generators in retail companies are: electricity, transport, ventilation, heating and cooking, refrigeration, and waste. The goal of all retailers is to take appropriate measures, primarily ecological in nature, to reach a planned reduction of carbon dioxide emissions in the future. Among other things, this is achieved with the increasing use of electricity from renewable sources (so-called "green energy"), by using modern ventilation, heating and cooking systems, refrigeration units, green logistics (ecological vehicles) and more efficient waste treatment. The effect of this is to improve the overall performance of retail companies (food), especially environmental.

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PROFITABILITY AND RISKINESS OF CATTLE FATTENING OPERATION IN SERBIA

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Abstract

Cattle production is the most important type of livestock production in Serbia. Dairy production as well as cattle fattening are usually performed at family farms which dominate in Serbian agriculture. Cattle fattening has special status within cattle production because of its long tradition and export potential for baby beef. Therefore combination of dairy production and cattle fattening is common at family farms and could improve economic performance of on farm level. Nevertheless, in recent years cattle fattening is in decline. One of the reasons is that cattle fattening is activity associated with broad range of risks. Therefore, the goal of this research is to determine how some types of risks influence profit in cattle fattening operation at family farms in Serbia. To achieve this goal, profit is calculated on the basis of revenues and costs which are determined for cattle fattening on family farm. Initially, profit is calculated for usual (expected) circumstances. Afterwards, it is analyzed how profit is influenced by changes in some important factors, such as subsidies, price of fattened cattle, price of calves for fattening and corn price. It was determined that profit was influenced the most by potential absence of subsidies, because without state support cattle fattening in Serbia would not be profitable enterprise. On the basis of scenario analysis it is possible to expect that in general cattle fattening should be profitable.

Key words: *Cattle fattening, profit, risk, family farms, subsidies.*

Introduction

Cattle fattening is one of the branches of livestock production with a long tradition in Serbia. However, there is a decreasing trend in the number of cattle so that it has fallen from 920,000 in 2014 to 893,000 in 2016. On the other hand, cattle meat production shows a trend of slight increase from 73,000 tons in 2014 to 77,000 tons in 2016 (Statistical Yearbook of the Republic of Serbia, 2017). Examining longer period (from 1985 to 2011) Dokmanović et al., (2014) determined that (comparing to the period from 1985 to 1990) production of beef decreased by 29.20% in the period from 2006 to 2011. When it comes to possibilities of beef export, there is a tradition of export from Serbia to Italy and Greece, but it has been broken for some time. At the moment, meat export does not have a significant influence within agricultural products export. However, as claimed by Bajramovic et al. (2016), Serbian beef export is larger than beef import. Problem related to cattle meat export is its low competitiveness index in relation to the EU market, while the same index for live cattle is much higher (Živkov et al., 2017). Nevertheless, the same authors claim that "The production of beef is the branch in which Central Serbia has potential to become competitive, primarily due to large pasture potentials, but also due to the access to price competitive animal feed from Vojvodina".

Research, so far, have showed that investments in this production are economically justified in Serbia (Ivanović, 2013), but if there are problems with providing cheap cattle feed these investments turn out not to be economically efficient (Marković et al., 2014). Papers of other authors indicate that cattle fattening operation is influenced by many factors. Syrucek et al. (2017) determined that the most influential parameters in cattle fattening operation were

purchase and selling prices and live weight gains of cattle. López-Paredes et al. (2017) investigated 17 important production traits influencing profitability in a large national beef cattle population, while Kopeček et al. (2009) focused on analysis of the economics of cattle fattening simulating two agricultural policy scenarios. Return and costs in small scale cattle fattening were also analyzed by Sarma and Ahmed (2011), Santana et al. (2016) and Şahin et al. (2009). Having all this in mind, the goal of this analysis is to determine revenue, costs and profit in cattle fattening operation at family farms in Serbia, as well as factors influencing profit the most.

Material and methods

Data used in this paper refer to real costs of cattle fattening at family farms operating in Pancevo municipality. In the example presented in the paper, 40 cattle are fattened in one production cycle. Cattles for fattening are male, Holstein Friesian breed, weighting in average 123 kg per head at the beginning of the fattening period and having 450 kg per head slaughter live weight (projected daily gain is 1,100 g/day). It is assumed that fattened cattle will be sold once a year. Price of calves for fattening, price of fattened cattle and feed price are taken from the STIPS database (System of Agricultural Market Information of Serbia). Amount of subsidies corresponds to current government regulations in this area. Calculation incorporating revenue and costs of cattle fattening is made in the paper. In order to make the calculation, methodology given by Gogic (2014) was used. Sensitive analysis was applied to analyze the influence of certain factors on profit in cattle fattening (various approaches to sensitivity analysis are described by Pannell, 1997), as well as scenario analysis (elaborated by Brigham and Gapenski, 1997) to perform more comprehensive risk assessment.

Results and discussion

In order to analyze economic effects of cattle fattening, a calculation containing the most important types of revenues and costs was made (Table 1).

Table 1. Calculation of profit in cattle fattening operation

No.	Element of calculation	Amount (RSD)
I	Revenue	4,540,000.00
1.	Fattened cattle	4,140,000.00
2.	State subsidies	400,000.00
II	Costs	4,212,142.51
1.	Calves for fattening	1,476,000.00
2.	Feed costs	1,764,120.00
3.	Straw	360,000.00
4.	Water	25,000.00
5.	Electricity	20,000.00
6.	Veterinary and medicine	150,000.00
7.	Labor cost	300,000.00
8.	Maintenance of buildings and equipment	10,000.00
9	Depreciation	64,502.00
10	Interest	42,520.51
III	Profit	327,857.49

Source: Authors' calculation

The most important element of revenue is revenue from fattened cattle, while structure of costs is dominated by calves for fattening and total feed cost. It is determined that this is a profitable production, but it is necessary to analyze how some factors influence amount of

profit. Within total revenues of the farm, the largest part is income made by fattened cattle sale. Therefore, it is possible to question how the change of fattened cattle price influences profit of the farm. Fattened cattle price in 2016 and 2017 was between 220 RSD/kg and 255 RSD/kg in regional slaughter houses in which they are sold (Graph 1), while the price used in initial calculations was 230 RSD/kg.
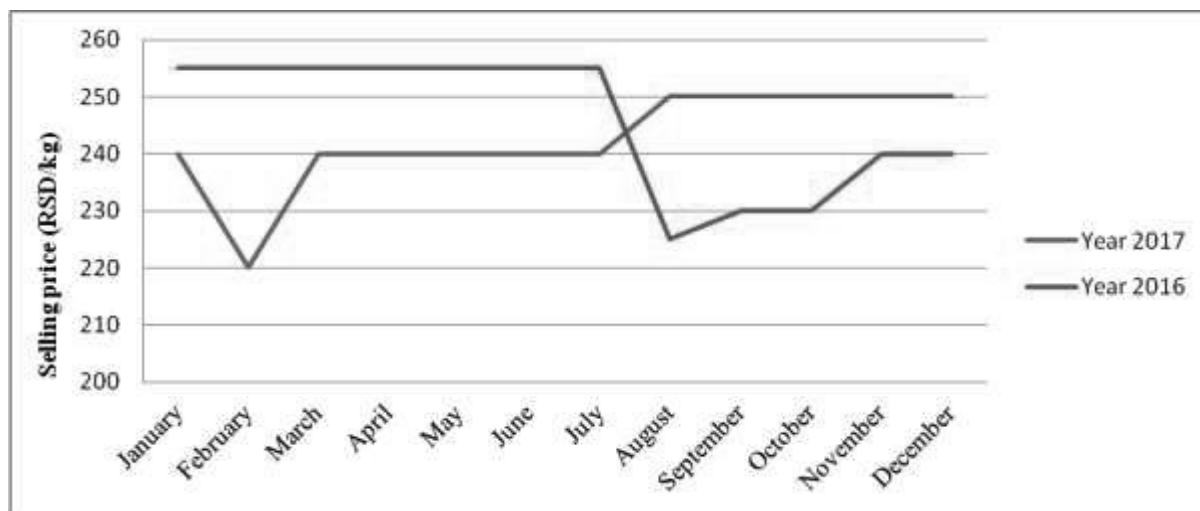
Graph 1. Prices of fattened cattle in Pancevo municipality in 2016 and 2017 (RSD/kg)
Source: STIPS database

Reduction of fattened cattle price from 230 RSD/ha to a minimal achieved price of 220 RSD/kg would lead to a profit decrease from 327,857.49 RSD to 147,857.49 RSD (decrease of 54.90%). However, minimal achieved price of fattened cattle will not lead to losses in cattle fattening. The next question to be answered is if cattle fattening would be profitable without state subsidies. Basic assumption is that a farm is officially registered with appropriate state agency and receives subsidies for fattened cattle. The alternative assumption will be that a farm is not registered and does not receive subsidies (Table 2).

Table 2. Influence of subsidies on profit in cattle fattening

Possibility	Profit (RSD)	Decrease of profit (RSD)	Decrease of profit
With subsidies	327,857.49	-	-
Without subsidies	-72,142.51	400,000.00	122.00%

Source: Authors' calculation

Results show that cattle fattening operation without subsidies results in loss instead of profit. It indicates a significant influence of subsidies on profitability of this production. Keeping in mind a decreasing trend in cattle fattening sector, as well as very low profit per head determined in this research (8,196.00 RSD/head) decrease of subsidies would lead to a further production reduction. That is to say, the amount of subsidies (10,000.00 RSD/head) is higher than profit in this production, which means that farmers use subsidies to cover part of production costs. As it was previously stated, cattle feed costs represent the biggest part of total farm costs. Within cattle feed costs, corn costs are very important element, so fluctuations of corn price were analyzed in the same county during 2016 and 2017 (Graph 2). The highest achieved corn price in the period 2016 – 2017 was 20.50 RSD and the lowest 15.00 RSD. The basic assumption was that corn price is 18.00 RSD/kg. Therefore, it is necessary to determine profit of the farm if the corn price is equal to the highest price in the period observed. Assuming that the corn price is 20.50 RSD/kg it would lead to a profit

decrease from 327,857.49 RSD to 201,977.49 RSD (profit would be reduced for 38.39%), but the operation would remain profitable.
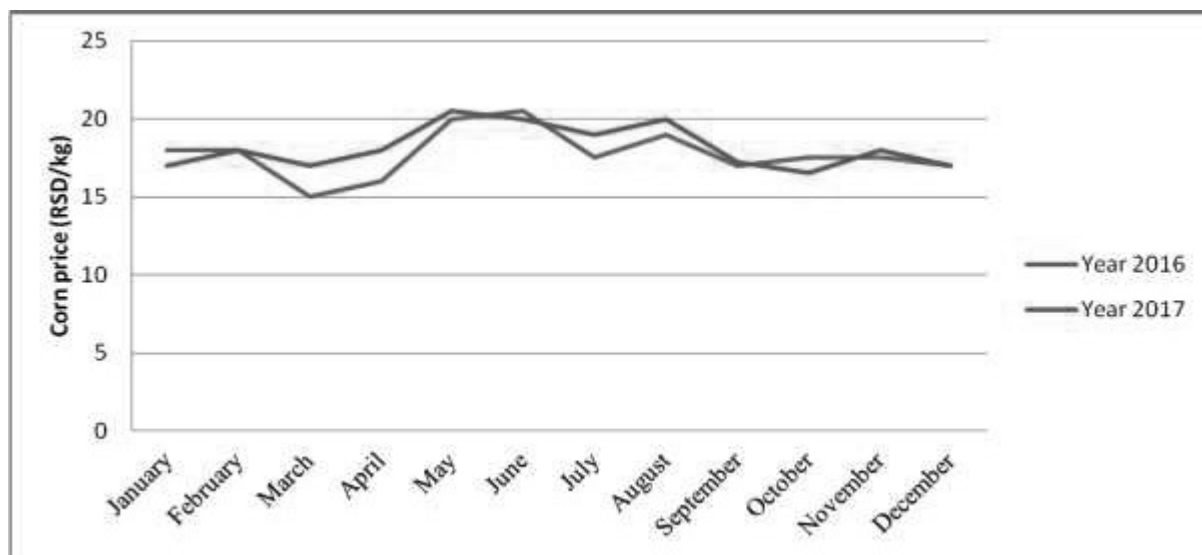
Graph 2. Fluctuations of corn prices in Pancevo municipality in 2016 and 2017
Source: STIPS database

Second type of costs ranked by their amount is cost of calves purchased for fattening. Prices of calves for fattening were fluctuating in 2016 and 2017 and it was necessary to determine their upper and lower limit (Graph 3). As it is showed in the graph, the highest price of calves in the market was 360 RSD/kg and the lowest one was 300 RSD/kg. Therefore, it is necessary to investigate how much the profit would reduce if the highest price of calves was used. It was determined that profit would reduce from 327.857,49 RSD to 75.857,49 RSD (the decrease would be 76.86%), but the production would remain profitable.
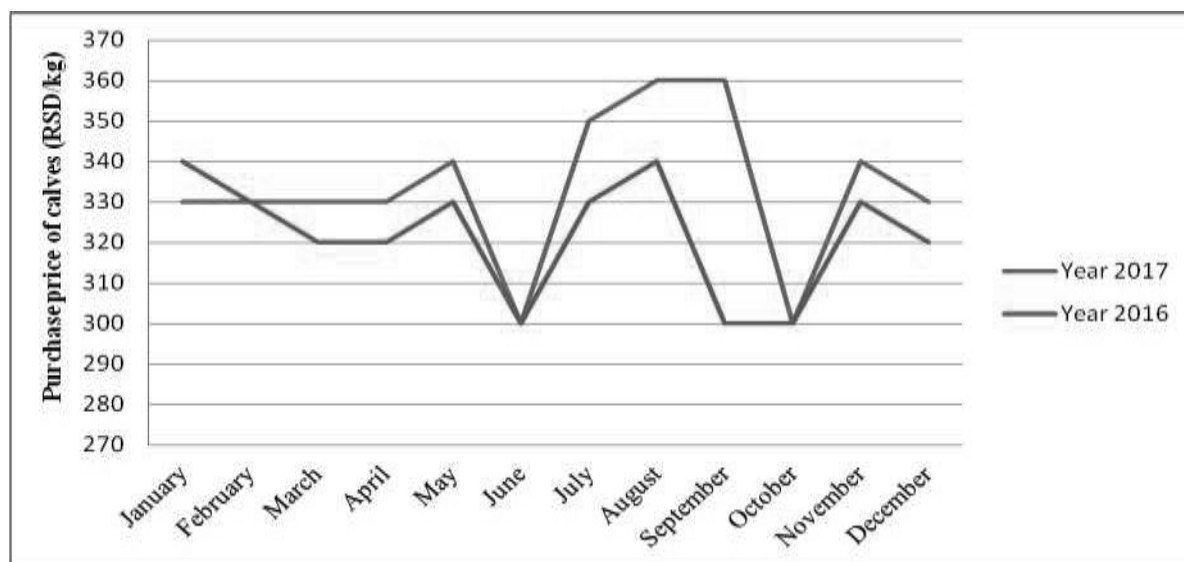
Graph 3. Fluctuations of calves for fattening prices in Pancevo municipality (2016 and 2017)
Source: STIPS database

Within previous sensitivity analysis basic assumption was that only one factor was changed, while all other elements of calculations remained unchanged. But, in reality, multiple elements of calculation will change at the same time. Due to that, it is possible to perform scenario analysis which involves projection of three possibilities (scenarios) for future – the best, the worst and the most likely scenario. The best scenario will represent optimistic

approach (all indicators will have the most desirable value) while the worst scenario will assume the least desirable value of all elements of calculation. The most likely scenario equals to basic assumption which is previously presented in Table 1. Within this research two scenario analysis will be performed (because both of them could happen in future), and the only difference is within the worst scenario. The first scenario analysis (Table 3) assumes that state subsidies do not exist in the worst scenario. On the other hand, the other type of scenario analysis assumes that state subsidies do exist in the worst scenario (Table 4).

Table 3. First type of scenario analysis

Scenario	Profit (RSD)	Probability of outcome (%)	Total (RSD)
Best scenario	1,071,936.49	0.25	267,984.12
Most likely scenario	327,857.49	0.50	163,928.75
Worst scenario	-792,378.51	0.25	-198,094.63
Expected profit			233,818.24

Source: Authors' calculation

Table 4. Second type of scenario analysis

Scenario	Profit (RSD)	Probability of outcome (%)	Total (RSD)
Best scenario	1,071,936.49	0.25	267,984.12
Most likely scenario	327,857.49	0.50	163,928.75
Worst scenario	-392,378.51	0.25	-98,094.63
Expected profit			333,818.24

Source: Authors' calculation

It could be seen that in both cases (having in mind three scenarios and their probability of outcome) it could be expected that cattle fattening operation would create profit.

Conclusions

This paper investigated how changes of certain types of revenues and costs influenced profit in cattle fattening at family farms. If each of the elements analyzed is observed separately, their least favorable values will lead to the profit decrease, but they will not create loss, unless there is a total abolition of state subsidies. If the best, most likely and the worst combination of factors observed (prices of fattened cattle, state subsidies, prices of corn and prices of calves) are analyzed through scenario analysis, the worst case scenario will always lead to a loss in cattle fattening activity. However, having in mind probability of occurrence of each scenario it could be expected that in general farm will make profit (even when it is assumed that subsidies did not exist as in the worst case scenario).

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