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CONTENT

IMPLEMENTING ARTIFICIAL INTELIGENCE AS A PART OF PRECISION DAIRY FARMING FOR ENABLING SUSTAINABLE DAIRY FARMING

Viktor Radun[1], Dragan Dokić[2], Vesna Gantner[3]

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A B S T R A C T

The purpose of this paper is to consider implementation of Artificial Intelligence as a part of Precision Dairy Farming, as a way of processing, analysing and managing Big data, in order to enable sustainable dairy cattle farm. Increasing the volume of livestock production in the future and measuring the level of environmental impact becomes one of the most pressing concerns. The aim is to evaluate the impact of animal's production level on the ammonium pollution from dairy cattle farm using precision dairy farming technologies. The results indicate significant variability in estimated ammonium pollution from dairy cattle farms due to the animal's production indicating positive correlation between daily milk production and ammonium pollution. The test day records, as Artificial Intelligence application in precision dairy farming could be used both for assessing the ammonium pollution from farms and timely prevention and correction of inadequate management towards sustainable dairy production systems.

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Introduction

Using latest technology in precision dairy farming radically changes the agricultural production as it enables tracking, monitoring, processing and analyzing huge amount of various data concerning measuring numerous important activities and factors during the dairy cattle farm production process. This implementation of technology includes using Artificial Intelligence (AI) together with Machine Learning and other new technologies,

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with the purpose of efficient managing Big data, which provides immense advancement in productivity and enhancing total economic output in farming sector.

The implementation of AI and Big data, among other precision dairy farming (PDF) technologies, proves to be challenging in ever more complex and volatile natural, technological and market environment in the perspective of the need to produce high quality standardized and sustainable products.

Given the need to increase the volume of animal production in the future and, accordingly, the level of environmental impact, this paper aimed to evaluate the impact of animal's production level on the ammonium pollution from dairy cattle farm using the artificial intelligence that is one of the most frequently applied precision dairy farming technologies.

AI as a key technology in the Fourth industrial revolution wave

It is widely recognized that Artificial Intelligence (AI) is one of the critical new technologies of the Fourth Industrial Revolution (IR4) or Industry 4.0. AI is defined as "the information-intensive transformation of manufacturing (and related industries) in a connected environment of Big data, people, processes, services, systems and IoT-enabled industrial assets with the generation, leverage and utilization of actionable data and information as a way and means to realize smart industry and ecosystems of industrial innovation and collaboration." (i-Scoop, 2020)

Klaus Schwab, who coined the term, in his seminal book *The Fourth Industrial Revolution* (Shwabb, 2016) claims that the IR4 is fundamentally different from the past three industrial revolutions. He stated that it is "characterized by a range of new technologies that are fusing the physical, digital and biological worlds, impacting all disciplines, economies and industries, and even challenging ideas about what it means to be human" (World Economic Forum, The Fourth Industrial Revolution, 2020). Industry 4.0 comprises high and dynamic interconnectivity of machines, products, components and humans. It has multiple benefits for the economy, which may be summarized as four main benefits: increased productivity, increased quality, increased flexibility and increased speed (i-Scoop, 2020).

According to BCG (BCG, 2020), nine core technologies are the crucial technological factors of Industry 4.0, capable of transforming industrial production: "a) Big Data and analytics; b) autonomous robots; c) simulation; d) horizontal and vertical system integration; e) industrial Internet of Things; f) cybersecurity; g) Cloud technology; h) additive manufacturing and i) augmented reality" (BCG, 2020).

Although AI was not specifically mentioned among those technologies, it permeates and links all segments and sectors of Industry 4.0 and enables radical transformation of the economy and society as a whole. It is difficult to define what AI exactly means, as it is no single technology, rather it comprises a set of technologies referring to image processing, self-learning, analytics, decision making and problem solving. AI is defined

in many ways, based on a spectrum of views on AI as a body of knowledge, application, and a set of technologies or approach.

The definition of AI used by European Commission is rather comprehensive and practical: "AI refers to systems that display intelligent behaviour by analysing their environment and taking action – with some degree of autonomy – to achieve specific goals" (European Commission, 2018). European Parliament states: "AI is the ability of a machine to display human-like capabilities such as reasoning, learning, planning and creativity" (European Parliament, What is artificial intelligence and how is it used?, 2020).

The importance of AI lays in its extensive use (in various fields and sectors of economy and society), interconnectivity and its ability of self-learning, continual improvement and adaptability. The impact of AI on economy is disruptive in a way that it is revolutionizing every aspect of life and work. Implementation of AI in industry leads to radical transformation of the production process in all sectors of economy, especially in manufacturing, travel industry and transportation as well as agriculture. Hence, there is indication that AI is going to be crucially important for building "factory of the future". According to BCG: "Producers can generate additional sales by using AI to develop and produce innovative products tailored to specific customers and to deliver these with a much shorter lead-time. AI is thus integral to the factory of the future, in which technology will enhance the flexibility of plant structures and processes" (BCG, 2018).

Due to the complexity and extreme adaptability and applicability of AI in various sectors of economy, it is quite difficult to predict the future dynamics of the growth of global AI market. Hence, we see different reports on the future of global AI industrial growth. According to the Report of the Grand View Research By End Use, By Region, And Segment Forecasts, 2020–2027 (Grand View Research, 2020), the estimated value of the global AI market size in 2019 was USD 39.9 billion. The expectation is that it will grow at a compound annual growth rate (CAGR) of 42.2% from 2020 to 2027.

According to PwC Report named "Sizing the prize", *Global Artificial Intelligence Study: Exploiting the AI Revolution: What is the real value of AI for your business and how can you capitalize?* (PwC, 2017), the expected global GDP in 2030 could be up to 14% higher as a result of AI usage. That would be a potential contribution to the global economy of 15.7 trillion US dollars by AI. Looking at regional distribution, the study shows that the biggest gain from AI in 2030 will be in economies of China (boost of up to 26.1% GDP) and North America (boosting 14.5% of GDP).

PwC study concludes that the great impact of AI on the global economy will be the result of these three main factors: a) improved productivity; b) increased consumer demand and c) some job displacement but also new employment opportunities.

Having understood the relevance of the AI as a key driver of the economic and social development and digital transformation of the EU economy as a whole as well as of its member states, European Commission has established the "European approach to Artificial Intelligence". This approach is based on three pillars (European Commission, 2020):

- •   Being ahead of technological developments and encouraging uptake by the public and private sectors;

- •   Prepare for socio-economic changes brought about by AI;

- •   Ensure an appropriate ethical and legal framework.

Implementation of AI in precision dairy farming

Use of AI has already revolutionized agriculture in many ways. The concept of precision agriculture was developed as a result of designing and transforming agriculture upon the digital transformation principles and by usage of AI and other core technologies of the industry 4.0. According to International Society of Precision Agriculture (ISPA), the precision agriculture is defined as "a management strategy that gathers, processes and analyses temporal, spatial and individual data and combines it with other information to support management decisions according to estimated variability for improved resource use efficiency, productivity, quality, profitability and sustainability of agricultural production" (International Society of Precision Agriculture, ISPA, 2020).

Precision dairy farming (PDF), as a sector of precision agriculture, is described as "the use of information and communication technologies for improved control of fine-scale animal and physical resource variability to optimize economic, social, and environmental dairy farm performance" (Eastwood et al., 2012). By another, more concise definition, the precision dairy farming "involves the use of technologies to measure physiological, behavioural, and production indicators on individual animals" (Precision Dairy Farming, 2020).

AI is intrinsically connected to Big data. AI enables effective and efficient use of the huge mass of data that we have as input in businesses. In addition, AI's need for Big data is limitless; in fact, there is a reciprocal relationship between AI and Big data – the more data enters, the more efficient AI is in analysing that quantity of data. There is a trend of converging AI with Big data technology. Yet, Thomas Siebel (Siebel, 2019) goes further and writes about converging of four essential technologies: Big Data, IoT, AI and Cloud computing. According to Radun, "the huge potential of AI in contributing to the improvement of performance, i.e. the growth of productivity, rationalization, business efficiency, rests on its *power of intelligent automation*. AI radically pushes the boundaries of automation and is able to make breakthrough in various areas of the economy, automating and accelerating the way of collecting and analysing data, business processes, ways of organization, decision-making, prediction capabilities, etc. From this point of view, the effects of AI are not only direct, through the direct implementation of a particular AI application in business, but also indirect, which lay in the unimagined possibilities of creating completely new products, services and branches in the future, resulting from applying AI as universal ability of intelligent, self-learning factor" (Radun, 2019).

There are great many biological and physical processes that should be observed and optimized in the dairy farming sector of agriculture. That is exactly why the role of AI, together with machine learning (subset of AI, sometimes used as synonym of AI), Big data, IoT, Cloud computing and other technologies is essential in processing, analysing and managing plenty of data occurring in the dairy farming production process.

Technologies used by farmers serve to observe many parameters about their cattle and working process. Among those parameters recorded by the PDF technologies are "daily milk yield, milk components, step number, temperature, milk conductivity, automatic estrus-detection monitors, and daily BW measurements… Proposed parameters include jaw movements, ruminal pH, reticular contractions, heart rate, animal positioning and activity, vaginal mucus electrical resistance, feeding behaviour, lying behaviour, glucose, acoustics, progesterone, individual milk components, colour (as an indicator of cleanliness), infrared udder surface temperatures, and respiration rates" (Borchers, Bewley, 2015).

The main purpose of implementing AI, machine learning, Big data, IoT and related technologies in PDF is to feed the system with as many data as possible (variables, parameters), including the ability to forecast changes in those data (weather, conditions, parameters) by which system may be trained, processing the great database of information, learning and finding the best solution.

For the producer, the decision to involve precision dairy farming technologies is a strategic issue. That is why it is crucial to observe the benefits and advantages of the technologies of the PDF. According to Precision Dairy Farming network, the main goals of implementing PDF may be various, and they can be summarized as the following ones: maximize production of animals, early detect the disorders or diseases on the individual level, early detect health and production problems on a herd level, as well as minimize the treatment costs by application of adequate preventive measures (Precision Dairy Farming, 2020).

The primary advantage of using PDF technologies is attaining greatly efficient, high-quality, sustainable dairy farming production, while keeping minimal bad environmental impact and enriched animal health. The PDF technologies, including AI, can help producers (dairy farmers) make decision-making processes more objective, improve the productivity and quality of the animal production and reduce the need for extra labour in animal management.

The second goal of the 2030 Agenda for Sustainable Development (United Nations, The 17 Goals) declares, "End hunger, achieve food security and improved nutrition and promote sustainable agriculture". In accordance with that specific goal, FAO states: "FAO works to enhance livestock's contribution to the Sustainable Development Goals (SDGs) by supporting the transformation of animal production systems – small and large – in ways that are economically, socially and environmentally sustainable" (FAO, 2020).

The application of artificial intelligence in animal production in some way implies usage of different precision technologies in order to detect animal's characteristics related to production, physiology and behaviour. These characteristics could be used in forecasting of the parameters related to enablement of production systems sustainability from the aspects of economic efficiency and impact on the environment. The impact of animal production on the environment, particularly in the light of climate change is one of the main points in the light of the forecasted increase in livestock production. According to FAO (FAO, 2006), the animal production sector will continue to be the most productive agricultural sub-sector considering global milk production is forecasted to increase to 1043 million tonnes in the following period till 2050.

This production increase need to be followed by appropriate environment protection measures (minimization of greenhouse gasses emission). In The Netherlands, for instance, the dairy farms are under monitoring using the content of urea in milk (Bijgaart, 2003). This way of controlling permits the determination of potential pollution sources and notifies farms regarding precautionary actions. In Europe, the optimum amount of urea content in milk is in the interval from 15 to 30 mg/dL (Ruska et al., 2017). Milk urea content could be used for estimation of ammonium pollution from daily farms. The reduction of ammonium pollution from dairy cattle farms represents major part in enablement of environmentally sustainable production systems.

Considering the necessity of timely information and reaction in animal production, the hypothesis of this research was that the application of technologies of precision dairy farming could contribute to more objective and successful management and overall economic and environmental sustainability of dairy cattle farms.

Furthermore, regarding the need to increase the volume of animal production in the future and, accordingly, the level of environmental impact, this *paper aimed to evaluate the impact of animal's production level on the ammonium pollution from dairy cattle farm using the artificial intelligence that is one of the most frequently applied precision dairy farming technologies*.

Material and methods

For statistical analysis, the test-day records of Holstein first parity cows recorded in the ten years' period (2004 to 2013) were analysed. Test-day records were recorded during the regular milk recording conducted by the Croatian Agricultural Agency according to the alternative milk recording method (AT4 / BT4) on dairy cattle farms in Croatia. At each milk recording, measuring of milk yield and milk sampling were conducted during the morning or evening milking. The SAS software was used for the Big data managing, logical control, formulation of new variables, development and testing of statistical model. The test-day records outside logical defined values (lactation stage in (< 5 days and > 90 days), age at first calving in (< 21 and > 36 months)), with missing information on parity, breed, and daily milk traits, were removed from the dataset. After logical control (for milk trait values ICAR standards were used; ICAR, 2017), the

database consisted of 105,033 test-day records from 50,218 first parity Holsteins reared on 4,693 dairy farms.

The calculation of the content of milk urea nitrogen (MUN) was done on the basis of the content of milk urea (UREA) using the mathematical expression:

MUN (mg/dL) = UREA * 0.46 (Spiekers & Obermaier, 2012)

Furthermore, the ammonium emission (A-EMISSION) was computed based on the content of milk urea nitrogen (MUN) using the mathematical expression:

A-EMISSION (g/cow daily) = 25.0 + 5.03 * MUN (Burgos et al., 2010)

In accordance with the production level (daily milk yield – DMY), the animals were divided into five classes: I (DMY ≤ 15 kg); II (DMY > 15, ≤ 20 kg), III (DMY > 20, ≤ 25 kg), IV (DMY > 25, ≤ 30 kg) and V (DMY > 30). In addition, the test day records, regarding the date of milk recording, were separated into 4 seasons (spring (months III, IV, and V), summer (VI, VII, and VIII), autumn (IX, X, and XI) and winter (XII, I, and II)).

Basic statistical parameters of daily milk production (daily milk yield and contents (fat, protein, and urea), daily content of urea nitrogen in milk and daily ammonium emission is shown in *Table 1*.

Table 1. Basic statistical parameters of analysed elements (daily milk traits, milk urea nitrogen and ammonium emission)

Variable	N	Mean	SD	CV	Minimum	Maximum
DMY	1719033	23.17	7.19	31.03	3.00	70.40
DFC	1655847	4.01	1.00	24.99	1.50	9.00
DPC	1670025	3.04	0.35	11.54	1.20	6.94
UREA	1465628	21.65	9.47	43.73	0.50	60.00
MUN	1465628	9.96	4.36	43.73	0.23	27.60
A-EMISSION	1465628	75.10	21.91	29.18	26.16	163.83

Note: DMY – daily milk yield (kg); DFC – daily content of fat in milk (%); DPC – daily content of protein in milk (%); MUN – content of urea nitrogen in milk (mg/dL); A-EMISSION – ammonium emission (g/cow daily)

The assessing of the impact of production level on the variability of analysed traits (daily milk yield; milk urea content, milk urea nitrogen content and ammonium emission) in first parity cows of Holstein breed, was performed by applying the subsequent statistical model:

$$y_{ijklmn} = \mu + b_1\left(d_i/305\right) + b_2\left(d_i/305\right)^2 + b_3 \, h\left(305/d_i\right) + b_4 \, h^2\left(305/d_i\right) + S_j + A_k + P_l + e_{ijklm}$$

where y_{ijklm} = estimated trait (daily milk yield; milk urea content, milk urea nitrogen content and ammonium emission);

μ = intercept;

b_1, b_2, b_3, b_4 = regression coefficients;

d_i = stage of lactation in days, i (i = 5 to 90 day);

S_j = fixed effect of season of milk recording, j (j = spring, summer, autumn, winter);

A_k = fixed effect of animal's age at first calving in months, k (k = 21 to 36 month);

P_l = fixed effect of animal's production level, l (l = I., II., III., IV. and V.);

e_{ijklm} = residual.

Scheffe's method of multiple comparisons (in PROC GLM / SAS (SAS (SAS Institute Inc., 2000)) was applied in order to test the significance of the differences between the analysed traits due to the defined classes of animals' daily milk production.

Results and discussion

The statistical analysis revealed statistically highly significant impact (p < 0.001) of all model's effects (age at first calving, stage of lactation, recording season, and level of animals' daily milk production) on analysed traits (daily milk yield; milk urea content, milk urea nitrogen content, and ammonium emission). Ruska et al. (Ruska et al., 2017) also found the significant impact of season on urea content in milk with higher content during the summer months. The LSMs of analysed traits, classified in production level classes (I, II, II, IV and V), are shown in *Table 2*.

Table 2. LSMs of daily milk yield, contents of milk urea and milk urea nitrogen as well as ammonium emission of first parity Holsteins regarding the production level

Production level	DMY	UREA	MUN	A-EMISSION
I.	12.03[A]	20.72[A]	9.53[A]	72.94[A]
II.	17.85[B]	20.44[A]	9.40[A]	72.29[A]
III.	22.56[C]	21.35[B]	9.82[B]	74.39[B]
IV.	27.43[D]	22.71[C]	10.45[C]	77.55[C]
V.	34.32[E]	24.02[D]	11.05[D]	80.59[D]

Note: DMY – daily milk yield (kg); UREA – daily content of urea in milk (mg/dl); MUN – daily contnet of urea nitrogen in milk (mg/dl); A-EMISSION – ammonium emission (g/cow daily); LSMs marked with different letters (A, B, C, D, E) differ statistically significant (p < 0.001)

The daily milk yield differed highly significantly, in statistical terms (p < 0.001) regarding the daily milk production level. The statistically highly significant (p < 0.001) lowest value of urea content in milk was determined in animals that had daily milk production under 20 kg. Similarly, those animals had lowest daily values of urea nitrogen content in milk as well as the lowest values of ammonium emission. Furthermore, the highest urea content in milk, urea nitrogen content in milk as well as ammonium emission was observed in animal with highest daily milk production. These results indicate that the amount of estimated ammonium pollution highly depends on animal's production level.

Spohr, Wiesner (1991) and Spann (1993) determined that increased milk urea content indicate complication related to feeding of highly productive dairy cows. In order to control the animal feeding, urea content in milk (UREA) is used in Europe (Kohn et al., 2002; Bucholtz et al., 2007) while in the USA the urea nitrogen content in milk (MUN) is commonly applied (Aguilar et al., 2012). Furthermore, Godden et al. (Godden et al., 2001) and Haig et al. (Haig et al., 2002) stated that in the countries that evaluate the usage of nitrogen and feeding efficiency, the urea content in milk is recommended as an indicator for optimization of farm management.

Conclusion

Our study showed the statistically highly significant (p < 0.001) impact of age at first calving, stage of lactation, season of milk recording and the level of animals' daily milk production on all analysed traits (daily milk yield, urea content in milk, urea nitrogen content in milk and ammonium emission). The highest content of urea and urea nitrogen in milk as well as ammonium emission was observed in animals with daily milk production higher than 30 kg. The results point to significant differences in ammonium pollution depending on the animal's production showing a positive association between daily milk production and ammonium pollution. The hypothesis of the research that the application of precision dairy farming technologies can contribute to more objective and successful management and overall economic and environmental sustainability of dairy cattle farms was confirmed. Furthermore, the test day records as a way of artificial intelligence (AI) application in animal farming (precision dairy farming) could be used for evaluating and monitoring the ammonium pollution from dairy cattle facilities as well as for timely prevention of inadequate management and enablement of sustainable dairy production systems. The results of the analysis indicate that the implementation of AI, Big data, IoT, Cloud computing and related technologies as new technologies within the precision dairy farming could have great perspective in enabling effective and sustainable dairy farming for the benefit of both producers and consumers.

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Conflict of interests

The authors declare no conflict of interests.

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CREDIT RISK ASSESSMENT OF AGRICULTURAL ENTERPRISES IN THE REPUBLIC OF SERBIA: LOGISTIC REGRESSION VS DISCRIMINANT ANALYSIS

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A B S T R A C T

Credit risk assessment of agricultural enterprises in the Republic of Serbia was analyzed in this research by applying discriminant analysis and logistic regressions. The aim of the research is to determine the financial indicators which financial analysts consider when analyzing a loan application that have the most influence on the decision to approve or reject a loan application. The internal determinants of credit risk of agricultural enterprises are analyzed, i.e., indicators of financial leverage, profitability, liquidity, solvency, financial stability and effectiveness. The analyzed models gave different results in significance of the observed indicators. The indicators that stood out as significant in both models are only indicators of profitability and solvency. The model of discriminant analysis has successfully classified rate 81.0%, while the logistic regression model has successfully classifies rate 89.8%. In modeling the credit risk of agricultural enterprises in the Republic of Serbia, the logistic regression model gives better results.

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Introduction

Many authors consider credit risk as one of the most important risks that can affect banks (Spasojević, 2013; Dragosavac, 2014). Credit risk is the risk that the client will fail to meet the obligations and terms of a contract. Credit risk is included in credit activities as well as in business and investment activities, payments and securities settlements (Sůvová, 2002). Many factors can affect credit risk, including those that are under the control of the bank and those that are beyond its control. Credit risk depends on two groups of factors: 1. exogenous (government regulations, general economic conditions, natural conditions, etc.); 2) endogenous (assessment of the creditworthiness of each client). There are various events generating credit risk and they can occur at any time in the life of a loan. Also, credit risk should be analyzed in terms of the clients' activity sector, taking into consideration the particularities of each client's business (Sbârcea, 2008). Agriculture is the activity sector with the highest risk, primarily due to characteristics of agricultural production including: dependence on climatic conditions, slow turnover of funds, specific method of reproduction, lower level of marketability, seasonal nature of work, etc. When modeling credit risk for agricultural loans, one must take into account the characteristics of both the agricultural sector and its borrowers. Performance of the sector is influenced also by economic cycles and it is highly correlated with the typology, commodity, and geographical location of the company (Bandyopadhyay, 2007). Agricultural production in the Republic of Serbia is of great importance, the share of agricultural production in total GDP is about 6% (World Bank, 2019). Consequently, the performance of agricultural enterprises in the Republic of Serbia is one of the crucial aspects of the national economy. The main information on agricultural enterprises is given in their financial statements. These reports provide a view of the financial position and business results for the observed period (Milić et al., 2018). Therefore, the paper analyzes the financial ratios considered by financial analysts when making a decision to accept or reject a loan application from agricultural companies. Researches related to the topic of credit risk of agricultural enterprises are rare. Given that Wen (2013) considers that nonperforming loans makes a negative result of the bank's credit risk, the author investigated the impact of indicators such as gross domestic product, interest rate and money supply on the ratio of nonperforming loans of the Agricultural Bank of China. The results of this study determined that all three observed factors have a significant joint impact on nonperforming loans. Shalini (2013) in a survey of farmers in India identified the impact of a number of microeconomic variables on agricultural credit management. This research also proposes measures that can minimize the number of nonperforming loans in India. In their research, Khanam and Hasan (2013) examined the factors influencing nonperforming loans from the agricultural sector, a bank in Bangladesh. The authors came to the conclusion that a high percentage of nonperforming loans reduces the productivity and profitability of banks. Muhović et al. (2019) investigated the impact of various indicators on the movement of nonperforming loans in three countries: Republic of Serbia, Bosnia and Herzegovina and Montenegro. Using the panel analysis authors came to the conclusion that both, microeconomic and macroeconomic factors stand out as significant.

Finding an appropriate model for credit risk assessment is becoming an increasingly important issue for the banking system of the Republic of Serbia, therefore the aim of this research is to demonstrate how a discriminant analysis and binary logistic regression models can be used for this purpose. In this paper we analyze credit risk assessment by using financial dataset consisting of 295 loan applications of one bank located in Serbia. The research started from the hypothesis that used models, discriminant analysis and binary logistic regression can be used to model the credit risk of the observed companies.

Material and methods

The selected indicators which are considered by financial analysts when making a decision of accepting or rejecting a credit loan application were analyzed by applying two statistical methods: discriminant analysis and binary logistic regression. These methods can be used to estimate the associations between a categorical outcome variable and various covariates. Logistic regression and discriminant analysis are widely implemented practically (Ahsan ul Haq et al., 2015). Logistic regression, unlike discriminant analysis, is not based on assumptions about data normality and correlation of independent variables.

Discriminant analysis

The method of discriminant analysis is a multivariate technique for analyzing differences between individual groups of features. Discriminant analysis determines which variables better explain or predict affiliation of observations to certain groups (Tillmanns&Krafft, 2017). It is used to determine the discriminant function and to classify objects into one or two or more groups based on a set of characteristics that describe the objects. The goal is to maximize the difference between two groups and minimize the differences between individual members of the same group (Gurný P. &Gurný M., 2013).

The discriminant function is a linear combination of discriminant variables (Hair et al., 2006):

$$Z_{jk} = a + W_1 X_{1k} + W_2 X_{2k} + \ldots + W_n X_{nk} \quad [1]$$

Z_{jk} = discriminant Z score of the discriminant function j for object k

a = intercept

$W_{i=1,2..n}$ = discriminant weight for independet variable i

X_{ik} = independet variable i for object k

Discriminant analysis is based on the following assumptions: 1) equality of variances and covariances of independently variables; 2) independently variables follow multivariate normal distribution; 3) independence (Ahsan ul Haq et al., 2015; Brusco et al., 2018). Kolmogorov-Smirnov test was applied for testing the normality of data.

Homoscedasticity is tested using Leven test and Brown-Forsythe group test. Box's M statistic was used for testing homogeneity of the group covariance matrices.

The test used to interpret the discriminant functions is Wilk's λ-test, which is a measure of the differences among group means of the explanatory variables, and it was used to ascertain the level of significance for each group prediction (Heil &Schmidhalter, 2014). The classification function coefficient analysis shows more about the importance of each indicator in the discriminant function.

Logistic regression

Logistic regression is a statistical technique for modeling categorical variables which is generally most widely used in biomedical research, but it is also increasingly used in areas such as business and finance, marketing and economics (Meyers, et al., 2006). Logistic regression is a special type of regression used to predict the outcome of binary variables, i.e., magnitudes that can have two possible outcomes (e.g., success / failure). The dependent variable in the binary logistic regression model must be dichotomous (Hosmer et al., 2013).

The model of logistic regression has a following form:

$$\pi(x) = \frac{e^{\alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k}}{1 + e^{\alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k}} \quad [2]$$

$\pi(x) = \frac{e^{\alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k}}{1 + e^{\alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k}} [2]$ Where $\pi(x)$ is the expected value of Y for a given value of X, while the α and ß1, 2...k corresponds to the parameters α and ß1,2...k from the linear regression model (Tekić et al., 2020). This function is nonlinear and in order to linearize it is necessary to perform an appropriate transformation.

If the logistic regression function is transformed, the function is following: (Kvesić, 2012):

$$\ln\left(\frac{\pi}{1 - \pi}\right) = \alpha + \beta_1 x_1 + \beta_2 x_2 + \cdots \beta_k x_k \quad [3]$$

The resulting equality is called logit and it is linear with the parameters ßi, i = 1 ... k. The method commonly applied for testing the parameters in the logistic regression model is the maximum likelihood estimator, while Wald statistic test is used to estimate the significance of coefficients (Basu et al., 2017).

The Hosmer-Lemeshow test was used to assess the suitability of the data to the model (Hosmer et al., 2013). The tool used to assess the predictive accuracy of the model is the classifications matrix. The applied methods included calculation of Cox & Snell and Nagelkerke pseudo-R^2 coefficients. These coefficients have the maximum value of 1 and the closer the value is to 1, the more accurate the model is (Walker & Smith, 2016).

Sample and used variables

The statistical analysis included 295 loan applications made by agricultural companies taken from a bank operating in the Republic of Serbia. These loan applications of agricultural companies were processed by the bank in the period 2017-2019. Software packages used for statistical data processing were SPSS 21 and R 3.6.3. As a dependent variable in this analysis, a dichotomous variable was observed: credit application approved (yes or no). A set of financial and accounting ratios, belonging to different categories such as liquidity, solvency, profitability and economic structure, were selected from the accounts of these agricultural companies as independent variables:

Table 1. Independent variables

Notation	Indicator	Explanation
LEV	Leverage	Total liabilities/total equity
NIIE	Interest ratio	Net income/ interest expenses
NIOI	Ratio of net income and operating income	Net income/operating income
ROA	Return on assets	Net income / total assets
ROE	Return on equity	Net income / total equity
LIQ	Liquidity	Current assets/ short-term liabilities
FLTA	Ratio of financial liabilities and total assets	Financial liabilities/ total assets
STB	Stability	Fixed assets-long-term liabilities/total assets
SOL	Solvency	Total equity/ total assets
EFF	Total cost-effectiveness	Total income / total expenses

Source: authors' review

The leverage indicator (LEV) indicates the degree of capital burden on total liabilities. In essence, the rule is that the lower the value of this ratio, the greater are the security of long-term creditors and the solvency of the company. Interest ratio (NIIE) measures how much space there is between interest costs and company earnings. The larger the space, the safer the claims of long-term creditors will be and vice versa. Net income and operating income ratio (NIOI): operating profit shows the company's earnings after all expenses have been removed, except for tax expenses and certain one-off items, on the other hand, net profit shows the profit that remains after all operating expenses incurred in that period have been deducted from sales revenue. Return on assets (ROA) and Return on Equity (ROE) are indicators of company`s profitability which are the most used in the analysis (Walsh, 2003). Liquidity (LIQ) is the ability of a company to meet its obligations as they fall due. It can be measured in several ways, we used quick ratio which analyzes current assets and short-term liabilities. Ratio of financial liabilities and total assets (FLTA) shows the degree of indebtedness of companies to banks. Ratio of financial stability (STB), this coefficient indicates how many long-term sources, which consist of capital and fixed liabilities, related to fixed assets. Indirectly this indicator indicates the size of working capital, which is important preservation factor liquidity, because it represents reserve liquidity. The fixed assets coverage ratio (SOL) shows the extent to which fixed assets are financed by equity. The limit value of this indicator is 1.

If the value of the ratio is above one, the company is considered to be solvent. The ratio of total cost-effectiveness of the enterprise (EFF) is obtained when total revenues and total expenditures are compared. When this ratio was less than 1, the company realized a lower amount of income from expenses and then cost-effectiveness is unsatisfactory.

Results and Discussions

Out of 295 observed loan applications, 207 applications were accepted, while 88 loan applications were rejected. A list of the independently variables analyzed during the loan application processing and descriptive statistics of intependently variables are presented in Table 2.

Table 2. Descriptive statistics of explanatory variables

Indicator	Mean	Minimum	Maximum	Std. Deviation
LEV	2.79	0.00	330.67	20.03
NIIE	3,547,573.33	710,210,000.00	741,030,000.00	87,575,655.17
NIOI	1.24	-4,280.86	456.49	364.59
ROA (%)	-7.38	-90.68	61.67	10.69
ROE (%)	2.72	-2,486.36	864.11	154.76
LIQ	6.88	0.03	689.79	42.67
FLTA	0.11	0.00	0.77	0.14
STB	0.41	-0.48	0.99	0.29
SOL	0.59	0.00	0.99	0.26
EFF	0.79	0.03	2.27	0.25

Source: authors' calculation

From the results shown in Table 2, it can be seen that the average indebtedness of the analyzed companies is 2.79, and it ranged from 0 to 330.67. The high average value of the debt ratio is a consequence of the high indebtedness of those companies in the sample that were not approved for loan applications. The same can be concluded for the other observed indicators, especially the indicators of profitability and effectiveness (ROA and ROE and EFF), whose average values are extremely low, due to the low profitability of the rejected companies in the sample. The liquidity of the observed companies was at a satisfactory level, the average observed value of the current liquidity ratio was above 2, which means that the ratio of current assets and short-term liabilities is higher than the recommended ratio of 2:1. The solvency of the observed companies is also endangered, the minimum value of the solvency ratio is 0, while the maximum is 0.99.

The analysis was started by testing the collinearity of the variables; a correlation matrix is used within the groups to show correlation between the variables (Table 3). From the results shown in Table 3 it can be seen that the highest correlation coefficients are determined between NIIE and ROE (r = -0.88), followed by NIOI and ROA (r = 0.56) and STB and SOL (r = 0.56).

Table 3. Correlation matrix

Indicator	LEV	NIIE	NIOI	ROA	ROE	LIQ	FLTA	STB	SOL	EFF
LEV	1.00	-0.28**	0.01	-0.04	-0.88**	-0.02	0.24**	0.01	-0.24**	-0.05
NIIE		1.00	0.12*	0.17**	0.31**	0.02	-0.07	-0.02	0.09	0.15**
NIOI			1.00	0.56**	0.08	0.02	-0.05	0.01	0.07	0.43**
ROA				1.00	0.26**	0.01	0.08	-0.12	-0.01	0.56**
ROE					1.00	0.01	-0.15*	-0.10	0.08	0.16**
LIQ						1.00	-0.09	-0.01	0.18**	-0.07
FLTA							1.00	-0.20**	-0.50**	0.08
STB								1.00	0.56**	-0.34**
SOL									1.00	-0.23**
EFF										1.00

Source: authors' calculation

**Corerelation is significant at the 0.01 level

*Correlation is significant at the 0.05 level

Levene's test is performed to test the assumption of homogeneity of variance for individual variables between groups. Brown-Forsythe test, which is based on Levene's test, is performed to test equity of group means (Table 4).

Table 4. Results of Levene's and Brown-Forsythe tests

Indicator	Levene's statistics	Sig.	Brown-Forsythe statistics	Sig.
LEV	8.724	0.003	1.966	0.164
NIIE	2.510	0.114	9.883	0.002
NIOI	39.602	0.001	6.796	0.011
ROA	25.131	0.001	28.339	0.001
ROE	9.590	0.002	1.340	0.250
LIQ	4.148	0.043	4.372	0.038
FLTA	14.875	0.001	10.797	0.001
STB	8.818	0.003	0.004	0.947
SOL	6.813	0.010	37.078	0.001
EFF	11.117	0.001	19.354	0.001

Source: authors' calculation

The results of Levene's test for all variables indicate that the variances are not homogenous. The results of Brown-Forsythe test show statistically significant group mean. Box's M test was used to test the existence of group covariance matrices homogeneity. The value of Box's M statistics is 4,016.011 with p-value<0.005, so it can be concluded that the groups' covariance matrices are unequal.

One of the assumptions of discriminant analysis refers to normality of the original data. Kolmogorov-Smirnov test statistic is applied for this purpose and all variables show deviations from the normal distribution. Based on the performed tests, it is noticed that no agreement was reached with the normal distribution, so the Box Cox transformation was performed.

Results of discriminant analysis

Based on the results shown in Table 5, it can be seen that only one canonical function was isolated.

Table 5. Results of discriminant function

Function	Eigenvalue	Canonical correlation	Wilks' lambda	Chi-square	Sig.
1	0.574	0.604	0.635	130.441	0.001

Source: authors' calculation

Eigen values are related to the canonical correlation and describe the power of discrimination function. The correlation is 0.604. Wilk's lambda tests how well two levels of independent variable contribute to the model and the significance of discriminant function. Confirmed results, Wilks' lambda =0.635 and $\chi 2$ = 130.441, correlation coefficient and eigenvalue indicate the significance of the function (Table 5).

In Table 6, explanatory variables are sorted according to the importance of separation.

Table 6. Structure matrix

Indicator	Function
ROA	0.555
SOL	0.509
EFF	0.365
NIOI	0.307
FLTA	-0.295
NIIE	0.265
LEV	-0.161
ROE	0.137
LIQ	0.105
STB	-0.005

Source: authors' calculation

The largest correlation with discriminant function is made by the variable ROA (0.555), followed by SOL (0.509). The variable STB (-0.005) has the smallest contribution and the smallest correlation. It can be, also, noticed that all coefficients are statistically significant.

Table 7. Coefficients

Indicator	Standardized coefficients	Discriminant function coefficients
LEV	-0.402	-0.405
NIIE	0.201	0.205
NIOI	-0.147	-0.150
ROA	0.730	0.790
ROE	-0.578	-0.580
LIQ	-0.005	-0.005
FLTA	-0.105	-0.107

Indicator	Standardized coefficients	Discriminant function coefficients
STB	-0.370	-0.369
SOL	0.851	0.911
EFF	0.300	0.311
Constant		0.001

Source: authors' calculation

Standardized canonical coefficients of the discriminant function (Table 7) represent a relative measure of the influence of each explanatory variable on the discriminant function. The explanatory variable showing the greatest discriminatory influence is SOL, second is ROA, then ROE, and the other explanatory variables have less influence. The most significant explanatory variables have a positive sign of the coefficient of discriminatory function, which means that with increasing profitability and solvency of the company increases the probability that the loan will be approved.

Based on the results from Table 7, the equation of isolated function is:

$$Z = 0.001 - 0.405TLTE + 0.025NIIE - 0.150NIOI + 0.790ROA - 0.580ROE \\ - 0.005LIQ - 0.107FLTA - 0.369STB + 0.911SOL + 0.311EFF$$

Results of logistic regression

The backward stepwise method is used to construct the regression model. The selection of variables is conducted in five steps. Only the results of the fifth step, final model, will be presented. Omnibus test, i.e., "goodness of fit" is applied to assess the predictive performance of the chosen model.

Table 8. Goodness of fit

Step	Chi-square	df	Sig.
Step 5	-1.706	1	0.191
Model	220.561	7	0.001

Source: authors' calculation

Goodness of fit test (Table 8) show that the chosen model has good predictive performance and differs statistically significantly from the initial model without independently variables (Sig. <0.05). Based on the results of the Hosmer-Lemeshow test, the same conclusion is reached.

Table 9. Hosmer and Lemeshow test results

Step	Chi-square	Df	Sig.
5	7.625	8	0.471

Source: authors' calculation

Based on the results of the Hosmer-Lemeshow test, it can be seen that the model is good for prediction (Sig.>0,05).

Both Cox & Snell R Square and Nagelkerke R Square coefficients are calculated to estimate the fit of the model to the data.

Table 10. Model summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
5	138.997	0.527	0.747

Source: authors' calculation

In the Table 10, the values of pseudo coefficients are presented. Nagelkerke's $R^2=0.747$ shows how well a linear model fits the data, indicating a strong relationship. Cox & Snell $R^2=0.527$ indicating that 52.7% of the variation of the dependent variable is explained by explanatory variables from the logistic model.

Table 11 presents information about the variables included in the final model (equation). Based on the results of the Wald test, the contribution of each independent variable is determined.

Table 11. Variables in the equation

Step	Variables	B	S.E.	Wald	df	Sig.	Exp(B)
Step 5	LEV	0.112	0.040	7.759	1	0.005	1.118
	NIIE	0.001	0.001	6.547	1	0.011	1.000
	NIOI	0.279	0.088	10.077	1	0.002	1.322
	ROA	0.352	0.167	4.422	1	0.035	1.422
	ROE	-0.117	0.046	6.340	1	0.012	0.890
	STB	-3.625	1.223	8.783	1	0.003	0.027
	SOL	9.216	1.646	31.352	1	0.001	10,055.766
	Constant	-2.788	0.612	20.752	1	0.001	0.062

Source: authors' calculation

From the results shown in Table 10 it can be seen that seven out of eleven independently variables are statistically significant. In the final model, the main indicators of influence are LEV (Sig = 0.005), NIIE (Sig = 0.011), NIOI (Sig = 0.002), ROA (Sig = 0.035), ROE (Sig = 0.012), STB (Sig = 0.003) and SOL (Sig = 0.001), while other four factors are not statistically significant predictors. All explained variables except ROE and STB have a positive sign of the regression coefficient, which means that with the increase of TLTE, NIIE, ROA and SOL it is expected that the loan application will be approved.

Based on the coefficients B of the independently variables in the model, its equation is:

$$Y = -2.788 + 0.112TLTE + 0.001NIIE + 0.279NIOI + 0.352ROA - 0.117ROE \\ - 3.625STB + 9.216SOL$$

Discriminant analysis vs. logistic regression

The Receiver Operator Characteristic (ROC) is measure for assessing logistic regression and classification performance of discriminant analysis model (Hosmer et al. 2013). The ROC curve is presented in Figure 1.

Figure 1. ROC curve
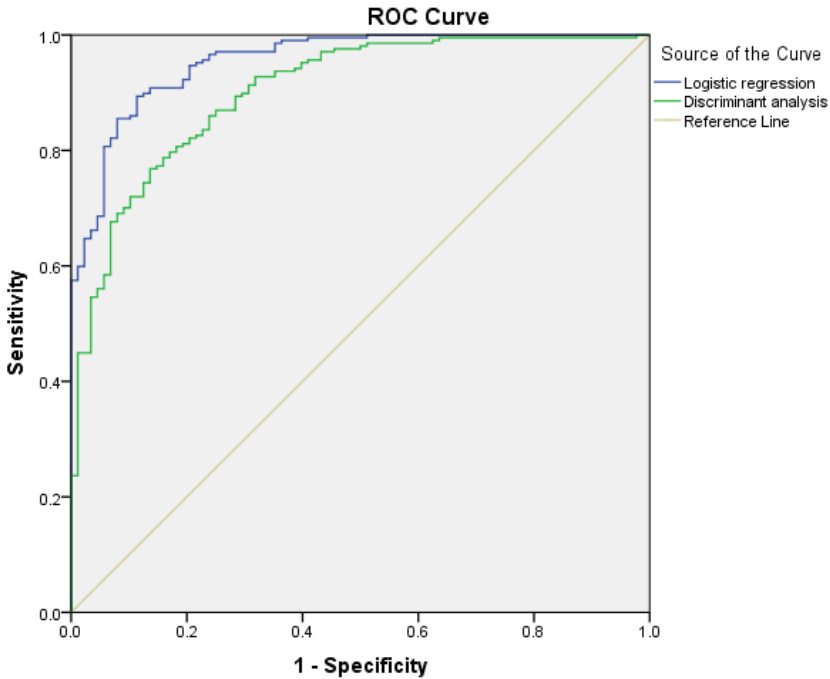
Source: authors' calculation

For the purpose of additional analysis of the predictive power of the two applied statistical methods, the area under rock curve (AUC) was calculated. If AUC has a value less than 0.5, the model has no predictive power.

Table 12. Area under the curve

Method	Area	Std. Error	Asymptotic Sig.	Asymptotic 95% confidence interval	
Discriminant analysis	0.902	0.019	0.000	0.866	0.939
Logistic regression	0.956	0.011	0.000	0.933	0.978

Source: authors' calculation

Based on the results shown in Table 12, it can be seen that the logistic regression has AUC of 0.956, while discriminant analysis has AUC of 0.902. The areas of both analyses show outstanding discrimination.

Table 14 presents the classification results of both statistical methods. The results of classification show how precisely the selected model predicts the categories of dependent variables. From the results of the classification, it can be seen that the model of discriminant analysis has successfully classification rate of 81.0%, while the model of logistic regression has successfully classification rate of 89.8%.

Table 13. Classification table

Loan application	Discriminant analysis		Logistic regression	
	Rejected	Accepted	Rejected	Accepted
Rejected	69	19	69	19
Accepted	37	170	11	196
Total (%)		81.0		89.8

Source: authors' calculation

In the next step of the analysis, the sensitivity and specificity of both models were calculated (Table 13).

Table 14. Comparison of models

Discriminant analysis			Logistic regression		
Sensitivity (%)	Specificity (%)	AUC (%)	Sensitivity (%)	Specificity (%)	AUC (%)
89.95	65.09	90.2	91.16	86.25	95.6

Source: authors' calculation

Based on results (from Table 14) it can be seen that logistic regression has higher sensitivity and specificity power than discriminant analysis. Also, based on the AUC values, it can be noticed that the logistic regression model is better than discriminant analysis model.

Conclusions

Credit risk modeling is a serious challenge in all branches of business, and certainly the biggest challenge is to model and predict credit risk in agriculture. In this paper we compared two statistical techniques: discriminant analysis and binary logistic regression to determine the influence of eleven ratio indicators on the likelihood that a credit loan application will be accepted. Based on the results of discriminant analysis, the most important ratio indicators influencing the approval of a loan application are total equity to total assets ratio, return on assets and return on equity (profitability indicators). Wilks' lambda test and the canonical correlation coefficient value shown the significance of isolated function. The results of binary logistic regression indicated that the most important predictors included: leverage ratio, net income to interest expense ratio, net income to operating income ratio, profitability ratios (ROA and ROE), stability ratio and total cost-effectiveness. Significance of logistic regression mode was confirmed by Omnibus test, Hosmer-Lemeshow test and Pseudo R Square coefficients. Both models show that solvency and profitability indicators stand out as significant determinants of credit risk of the observed agricultural enterprises. The comparison of

models was performed by using the overall classification rate, sensitivity, specificity and area under the ROC curve (AUC). The results showed that the logistic regression model exceeds the discriminant analysis model in all observed parameters. Based on all the above, it can be concluded that both statistical models can be successfully applied in financial institutions when modeling credit risk, but that for analyzed enterprises from the Republic of Serbia, the logistic regression model is a better basis for prediction.

It is important to note that the research was conducted on a sample of only 295 agricultural companies, for the period of the last three years, so in the future researches, the sample size should be increased.

Conflict of interests

The authors declare no conflict of interest.

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FOOD SAFETY AND EATING HABITS DURING PANDEMIC COVID-19 IN THE REPUBLIC OF SERBIA

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A B S T R A C T

Food safety is of paramount importance at all times, especially in exceptional circumstances, such as pandemic COVID-19, given the fact that coronavirus is spreading rapidly and little is known about coronavirus. Protections have been strengthened in all fields, including food safety. In order to best protect ourselves and others, it's necessary to handle food properly, especially if children, pregnant women, the elderly and the ill ones are in the immediate vicinity. The paper will examine food safety and eating habits during pandemic COVID-19, with focus on recommended guidelines for safe food preparation, food storage, together with the prescribed measures of the Government of the Republic of Serbia.

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Introduction

SARS-CoV-2 (coronavirus) was detected in December 2019, Wuhan market (China) in patients who had symptoms of viral pneumonia (Kaul, 2020; Naserghandi et al., 2020; Petrosillo et al., 2020). SARS-CoV-2 (coronavirus) virus causes COVID-19 disease,

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transmitted by droplets during sneezing and coughing; it lands on an exterior accessible to humans, and by touching the eyes, mouth and nose with hand, humans can become infected (Borges do Nascimento et al., 2020). The original name of the coronavirus was 2019-nCoV, but it was later renamed SARS-CoV-2, as a result of the discovery of similarity of the virus with the SARS-CoV genome. (Chang et al., 2020; The Lancet Infectious Diseases, 2020). Symptoms include: fever, fatigue, high temperature, muscle aches, cough, loss of taste and smell. Approximately 1 in every 5 people affected by COVID-19, becomes seriously ill and develops difficulty breathing, and a fatal outcome is possible (World Health Organization, 2020). There are several hypotheses about the transmission of the coronavirus to humans, but none of these has been confirmed yet.

Based on limited initial transmission from human to human and clustering of cases at the Wuhan market (China), with the knowledge that coronavirus originates from animals as well as the link of SARS-CoV-2 to the coronavirus bat, there is a likelihood of zoonotic transmission in the first stage (Ahmadiara, E. 2020). Two-thirds out of 41 people, who previously visited Wuhan market and were infected with coronavirus - had close contact with meat and seafood products, which may indicate that the coronavirus can be transmitted from animals' products to humans (Guan et al., 2020; Harapan et al., 2020; Naserghandi et al., 2020).

Although research has shown that inactivation of the virus is happening faster in the area of high temperatures ($\geq 50°C$), there are speculations that consumption of soup prepared by bats actually might be one of the probable causes of the spread of coronavirus (Lai et al., 2020; Sun et al., 2020). However, there is no confirmation that animals are the source of spreading COVID-19 (Katri, J. 2020). So far there is no evidence that coronavirus is spreading through food or food packaging (Food and Agriculture Organization of the United Nations & World Health Organization, 2020).

There are already more than 85,172,095 reported cases and 1,844,153 deaths worldwide caused by coronavirus (World Health Organization, 2020), and these numbers are growing on daily basis. At the moment (Dec 2nd, 2020), the United Kingdom is the first and only country to approve coronavirus vaccine (www.gov.uk). The Pfizer/BioNTech is the first approved vaccine against COVID-19, developed in 10 months, which is considered a fairly short period, taking into account that the usual drug development and approval procedure takes 10 years.

Food safety in the Republic of Serbia

First case of infection SARS-CoV-2 (coronavirus) in the Republic of Serbia was recorded on March 6, 2020. A few days later, on March 11, 2020, the WHO declared a pandemic. In severe cases, symptoms such as: pneumonia, acute shortness of breath syndrome, sepsis and septic shock occur, can cause patient's death. People suffering from chronic diseases seem to be more susceptible to severe forms of the disease.

In 2020, 337.923 COVID-19 cases have been registered in the Republic of Serbia, with number of deaths reaching 3.211. At the very beginning of the pandemic, there were high concerns

about food safety and food handling, with special emphasis on the right way to prepare a safe meal. In order to address these concerns, the Government prepared and strongly advised following special guidelines, along with good manufacturing practice (www.vet.minpolj.gov.rs):

- The raw material from which food is prepared must come from healthy animals
- Food must meet microbiological criteria (hygiene and safety)
- During food preparation, water that is used must be of drinking water quality
- Raw and prepared food should be stored at the prescribed temperatures.

It is the right of all consumers to expect safe, clean and quality food. Thus, safe food handling should be applied to prevent hazards. Food safety can be ensured by following & applying HACCP principles (Hazard Analysis Critical Control Point), (Kilibarda, 2019), together with GHP (Good hygiene practices), and Good manufacturing practices. Good hygiene practices are set of prerequisite requirements created with aim to prevent food contamination. Hygiene requirement can be applied both to households and hospitality sector including: personal cleanliness; training programs; maintenance; cleaning; waste management; environment hygiene; pest control; hygienic production of food sources; transport; food storage; lightning (European Commission, 2004). Good manufacturing practice (GMP) are set of recommendations from authority agencies with aim to meets fundamental food quality requirements. Importance of GMP and its application in the food business sector refers to food quality control at all times. HACCP system helps to lookout for potential hazards in the food chain, and to effectively assess hazard's location, the hazard level of threat for food safety, but also to control or reduce hazards to the appropriate level (Borovcanin & Kilibarda, 2020).

To stay competent and sustainable in today's modern business world, hospitality companies need to follow latest procedures by HACCP principles, GMP and GHP. Good manufacturing practices provide guidance for manufacturing, testing and quality insurance in order to ensure that a food is safe for human consumption. Food safety is major concern for customers and hospitality sector, but these concerns can be reduced by following the principles prescribed by health authorities, and this way food safety value can be increased in hospitality industry immensely (Manning, 2018). Lack of good manufacturing practice, could potentially lead to food contamination (Rossi et al., 2018). According to Serbian Food & Safety Law 17/2019 (Serbia, 2019), all food and beverages business are obligated to set up a safe structure of food production, together with the principles of HACCP.

Additional security measures (in correlation to COVID-19 infection) of public health authorities for food producers / owners of catering facilities - restaurants, hotels, motels, caffes, pastry shops, in the Republic of Serbia, include:

- Staff with COVID-19 symptoms should not work, alone or with colleagues
- Careful handling of raw meat, milk or animal organs, avoidance of uncooked food contamination, cross-contamination and consumption of raw or uncooked animal products

- Regular cleaning and disinfection of dishes, washing clothes, equipment, work surfaces, as well as all rooms (since coronavirus can be alive for 72 hours on facilities such as packaging material, food stations, polyvinyl chloride surfaces, cups, stainless steel, plastic products)

- Limiting the number of people in the kitchen at any time – keeping safe distance

- Limiting the number of guests who can come to the restaurant

- Using glows, wearing masks, using hand sanitizers at all times

- Adherence to the rules and guidelines of WHO/other competent institutions.

Household protection measures include compliance with the following four food safety steps, which are important at any times (www.foodsafety.gov):

1. Food cleaning

2. Proper food separation

3. Cooking food at appropriate temperatures

4. Food refrigeration.

A significant number of cases of foodborne diseases in the household are reported by the European Food Safety Authority (EFSA, 2018), followed by cases in food-service sector. In the last ten years, in Great Britain, United States of America, Australia and New Zealand, close to 90% foodborne diseases are related to food being prepared or consumed in the household (Baltic et al., 2013). Despite the fact that most consumers assume that foodborne diseases occur when consuming food outdoor (restaurants, bars, hotels), studies show that most food poisoning occurs when preparing food at home (Baltic et al., 2013). It has been found that 25% of cases of foodborne illness recorded in the household are related to inadequate food handling and storage (Baltic et al., 2013). Food experts agree with the above-mentioned fact that a number of foodborne illnesses occur as a result of improper food handling and preparation by the customer, although customers themselves are not aware of this fact (Vorsfold & Griffith, 1997). To avoid and prevent foodborne illness in the household, public health authorities must share information on how food is handled, including proper storage and thermal processing of food. It is best to thermally process food by cooking, heating to a temperature of 149 ° F (65 ° C), for at least three minutes. As COVID-19 is a global issue, it is clear that food safety is under scrutiny on a global scale. According to Jingjing et al., (Jingjing, Y., Yonglong L., Xianghui, C & Haotian C, 2020) some of the proposals for improving global food safety are:

1. Raising awareness of the dangers of wildlife consumption

2. Strengthening legislation on food and wildlife trafficking

3. Improving food safety standards

4. Establishment of market supervision mechanism.

Materials and methods

The research is focused on opinions of the respondents regarding food safety, as well as their eating habits. The paper research uses the online survey method and in person interview. Data collection was conducted in the period September 1, 2020 – November 1, 2020. The sample of the study consists of 130 respondents, aged 18 to 60+ years. The questions include demographic characteristics, followed by questions about food safety opinions and attitudes, and finally questions about eating habits during a pandemic. Minor part of the data was collected in person during the mentioned period, while the other part was collected through an online survey. The survey was explicitly designed for this research. SPSS (SPSS Statistics 22) was used to analyze all collected responses. Descriptive statistical analysis was successfully used to illustrate the dietary habits of the respondents, taking into account the opinions of the respondents regarding food safety. Pearson correlation coefficient was used to measure correlation between two variables – respondents' age and their awareness on food safety. The Likert scale was also used to evaluate the answers, where 1 means "I completely disagree", while 5 stays for "I completely agree".

Results

Demographic characteristics of the respondents indicate larger number of women (65%) compared to the male population (35%). Significant number of respondents has faculty degree (41%), followed by master degree (28%), high school (20%), college degree (6%) and PhD (5%). Further demographic details are presented in Table 1.

Table 1. Demographic characteristic

Section	Status	Respondent number	%
Gender	Men	46	35
	Woman	84	65
Age	18-25	22	17
	26-40	80	61
	41-50	14	11
	51-60	8	6
	61+	6	5
Education	High school	26	20
	College	8	6
	Faculty	54	41
	Master degree	36	28
	Phd Degree	6	5
Respondent status	Employed	100	77
	Unemployed	2	2
	Student	16	12
	Entrepreneur	8	6
	Retired	4	3

Source: Authors' findings

In addition to this, the majority of respondents live in Belgrade (75%), Novi Sad (15%), Nis (6%), while 4% of research data were collected in person during the respondents' visit to Belgrade. Of all respondents, 22% people work in the food and beverage sector. Along with demographic inquiries, the research contains three sets of questions, presented in Table 2. The first set of questions is related to food safety, and the other two are related to eating habits during COVID-19.

Table 2. Sets of questions for research

1.	**FOOD SAFETY AND GOOD HYGIENE PRACTICE** Aim: To determine if pandemic influenced awareness on food safety and daily habits related to food hygiene.
1.1.	How long do you wash your hands after the outbreak of COVID-19?
1.2.	Did you disinfect each food after purchase, before COVID-19?
1.3.	Do you disinfect each food after purchase, during COVID-19?
1.4.	If you disinfected food during the COVID-19, what did you use for this purpose?
1.5.	After COVID-19 outbreak, how would you rate the importance of hand hygiene?
1.6.	How much COVID-19 affected your awareness of the importance of food safety?
2.	**TYPE OF FOOD IN DAILY NUTRITION** Aim: To determine whether pandemic affected type of food that is consumed on daily basis, given that meat was initially in correlation with COVID-19.
2.1.	Do you consume more vegetables after the COVID-19 outbreak?
2.2.	Has COVID-19 affected the increased intake of fruits and fruit products in your daily nutrition?
2.3.	Do you consume more sweets during the COVID-19 pandemic?
2.4.	How much has COVID-19 increased your alcohol consumption?
2.5.	Have you stopped consuming some foods during COVID-19?
3.	**FOOD PREPARATION PROCESS** Aim: To determine if food preparation process has undergone changes due to pandemic and local measures that followed it.
3.1.	How much has COVID-19 affected your frequency of food preparation at home?
3.2.	As a consequence of the COVID-19 pandemic, have you adopted new ways / methods of food preparation?
3.3.	How much did the outbreak of the COVID-19 pandemic affect your eating habits?

Source: Authors' findings

Forasmuch demographic characteristic of respondents and the subject matter, following research hypothesis are tested:

H1: Awareness on food safety during COVID-19 is not related to age.

H2: Changes in eating habits during the COVID-19 do not depend on gender.

Analysis of respondents' opinion on food safety

Handwashing was emphasised as an important precautionery measure, with regards not only to food safety, but safety and health in general (WHO, 2019). Also, Centers for Disease Control and Prevention (CDC) recommends washing hands for 20+ seconds with water and soup, or if water or soup is not available, a hand sanitizer with 60% of alcohol can be used as a substitute (CDC, 2020). Our research showed that 15% of respondents wash hands for 20+ seconds, 55% of respondents wash hands beetwen 10-20 seconds, while 30% wash their hands around 10 seconds. Unlike other age groups, only respondents age 18-25 and 26-40 wash hands 20+ seconds or longer.

On the other hand, Carl et al. (2013) in their study, claim that average time among respondents to wash their hands is less than 7 seconds. According to study by Guzek et al (2020) conducted in Poland, among 384 respondents, reported handwashing time for man: less than 5 seconds (0.4%), 5-10 seconds (3.8%), 11-20 seconds (11.9%), 21-40 seconds (65.8%), 40+ seconds (10.1%), time doens`t mater (4.5%), and „I don`t know" (3.4%); and female: less than 5 seconds (0.3%), 5-10 seconds (1.9%), 11-20 seconds (10.1%), 21-40 seconds (74.2%), 40+ seconds (9.5%), time doesn`t matter (1.3%), and „I don`t know" (2.5%). According to Olaimat et al survay (2020), 66.8% of respondents wash their hands for less that 20 seconds.

These results may indicate that during the pandemic period, respondents wash their hands longer than before the pandemic. To effectively prevent the spread of germs from hands, it is recommended to wash hands for more than 20 seconds (WHO, 2019).

When it comes to food disinfection, 72% people included in the research have never disinfected all the food/groceries before pandemic, 17% did it at times, while 11% did it all the time. After COVID-19 outbreak, 35% of respondents claimed that they still don't disinfect all food after purchase, 37% disinfect food sometimes, while 28% of respondents do so constantly. These results indicate that our respondents pay less attention on food disinfection, before the pandemic. The European Food Safety Authority (EFSA, 2020) advocates that food disinfection can be avoided if certain prerequiste measures are taken: (1) handwasing (20+ seconds; water+soup) before and after food purchace, (2) ordering food online, (3) touch only the food that you intend to buy. On the other side, the Brazilian Association of Clinical Nutrition (2020) has advised proper hygiene practices whenever possible. The same assosiation suggest the use of water in combintion with soup or alcohol (70%) when handiling groceries.

According to Food and Agriculture Organization of the United Nations (FAO, 2020), 5 recommended steps for food safety are: (1) separation heat-treated food from fresh; (2) cook food at the right temperature; (3) store food at the right temperature; (4) use tap water when cooking; (5) maintain food hygiene (cleanness). The interesting result is that all respondents who do not work in hospitality (100%), answered that during pandemic they started to disinfect groceries prior to preparation, while before pandemic 76% of them never did it, 16% did it occasionally and 8% did it on a regular basis. Respondents working in hospitality sector answered in the following manner: before pandemic, 57%

never disinfected groceries, 21% did it at times, and 22% did it regularly, while after pandemic 42% still don't do it, 36% do it occasionally and 32% do it all the time. With respect to this result, it is obvious that pandemic has had a strong impact on awareness about food safety among the general population, while hospitality workers have not raised their awareness to a large degree, yet they rather kept their old habits. When disinfecting groceries, more than half of respondents (63%) used water only or water combined with soda, while the rest used alcohol (25%), chemical (7%) or other products (5%). From these answeres we can see that water is still leading liquid used to disinfecting food, followed by alcohol and chemicals. It is not suprise that alcohol is on the second place; usage of alcohol-based sanitizers has increased compared to other liquids (Gold & Avva, 2018). However, disinfection methods should be used wisely, as most people may possibly use inappropriate disinfectants, believing that all disinfectants on the market can eliminate coronavirus (Quevedo et al., 2020). Further detailed results according to gender are given in the Figure 1.

Figure 1. Food disinfecting habits – gender differences
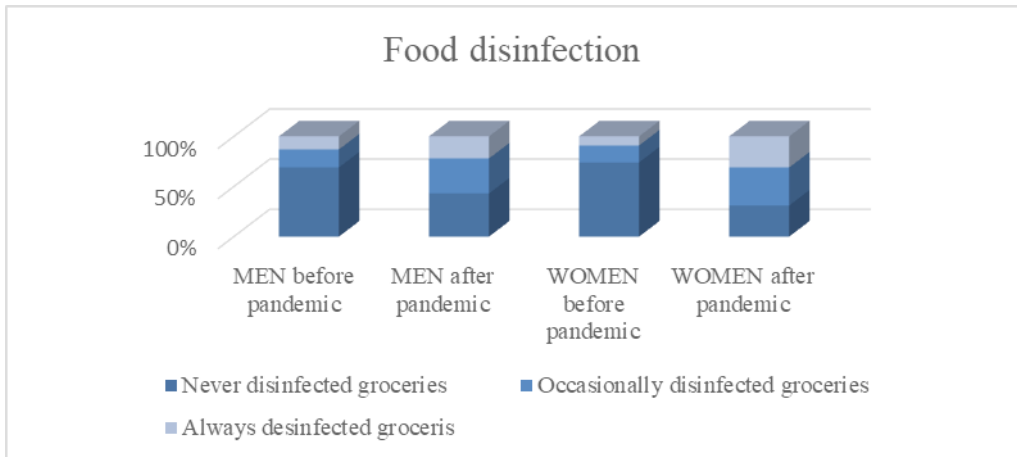
Source: Authors' findings

Althought it is clear that pandemic affected people's awareness on food safety, average respondents' answer to question "*How much COVID-19 affected your awareness of the importance of food safety?* " was 2.96 out of 5 on Likert scale. Men' rate 3.17 was to a certain extent higher than women' 2.85. Study in Qatar by Hassen, El Bilali & S Allahyari, (2020) reported that education level had effect on food safety awareness, food delivery, changes in behaviors affected by pandemic among respondents. Quao et al. (2012) argues that knowledge of food safety laws among consumers is not impressive at all. In support of this claim, Yin and Han (2014) claim that people who are prone to panic are people with lower education level. In China, study by Shi, Xiang and Zhang (2020), mention that pandemic certainly affected people's awareness of behavior and the importance of food safety.

The same survey highlights that with improvement of food safety knowledge, customer behavior should change as well. Food safety awareness among people of different age, in this research, ranges from 2.81 to 3.33.

In line with H1, which states that awareness on food safety during COVID-19 is not related to age, Pearson correlation coefficient was used to measure correlation between two variables (Table 3).

The first one presents age of respondents (initial value is used), and the second one presents results on Likert scale.

Table 3. Correlation between age and food safety awareness

RESPONDENTS' AGE	AGE (Variable 1)	VALUE (Variable 2) Food Safety Awareness
18-25	18	2.81
26-40	26	3.05
41-50	41	3.29
51-60	51	1.75
61+	61	3.33

Source: Authors' findings

According to numerical variables given, Pearson correlation coefficient (r), is -0,08. Negative correlation generally indicates that two variables do not increase together. As $0<|r|<0.10$ (absolute value), correlation between these two values is insignificant.

In other words, increasing the age of the respondents does not lead to increased awareness on food safety. On the other hand, Jay et al (1999), in their Australian study, report that awareness/knowledge of food safety among respondents increased with the age. According Shi, Xiang and Zhang (2020), respondents between 18-25 showed really low knowledge on food safety compared to elderly respondents ≤50 where score was high. Moreover, in the same study, the level of education appears to be non-linear related to "customer knowledge on food safety".

Analysis of respondents' opinion on eating habits

In addition to food safety analysis, this paper also presents results on eating habits before and during the COVID-19 pandemic, via descriptive statistics. Information related to eating habits of both genders are given below (Table 4).

Table 4. Eating habits of female and male respondents

	QUESTIONS ON EATING HABITS	MEN	(%)	WOMEN	(%)
		YES	NO	YES	NO
1.	Do you consume more foods of plant origin after the COVID-19 outbreak?	9%	91%	10%	90%
2.	Has COVID-19 affected the increased intake of fruits and fruit products in your daily nutrition?	**35%**	65%	21%	79%
3.	Do you consume more sweets during the COVID-19 pandemic?	17%	83%	**31%**	69%
4.	As a consequence of the COVID-19 pandemic, have you adopted new ways / methods of food preparation?	13%	87%	**29%**	71%

Source: Authors' findings

According to the study, subjects used food of animal origin in their diet very frequently before the outbreak of COVID-19. This is confirmed by very high value (4.17) on scale from 1 to 5, where 1 stands for „I don't eat meat" and 5 stands for „ *I eat meat every day*"; men' value was a bit higher (4.22) in comparison to women' (4.14).

A recent study published in November 2020, states that meat (bats and pangolins) could be associated with the coronavirus (Duda-Chodak, Lukasiewicz, Zięć, Florkiewicz, & Filipiak-Florkiewicz, 2020). Based on fear that certain meat could be related to virus, there is a possibility of reduced meat consumption in the future (FAO, 2020). In our study, only 8% of respondents started using more vegetables than meat in their diet during the pandemic. Further research reports that more than a quarter of total number of respondents (26%) have increased daily fruit intake in comparion to pre-pandemic period, while the same percentage (26%) started to eat more sweets in examined period. Another study in Qatar by Al Thani (2018), highlighted that 83% of the people consume less vegetables, legumes and fruits, 70% of the respondents are overweight, and lastly 47% of the respondents noted constant fast-food intake. According to Chenarides et al. (2020), from the outset of COVID-19 pandemic, food consumptions among respondents (60%), remained almost the same, 13% stated "consume less food", 21% said "they consumed more food", the rest 6% stated "healthier nourishment". Hassen, El Bilali & S Allahyari (2020), in their study highlighted increased consumption of vegetables and fruits (32.4%), as well as consumptions of "healthy foods" 32.3%. However, as a result of these data, increased vegetable intake among subjects may have been related to the current period of the pandemic.

Further, when asked about alcohol consumption and the impact on this habit, the average value on Likert scale was quite low, 1.85 out of 5. Women had a bit higher average value, 1.93 compared to men' value 1.7 meaning that they increased alcohol consumption more than men. Nielsen Company Survey conducted in March 2020 in the USA, share interesting results, alcohol orders online rose by 240% (Micallief, 2020). Also, an increased number of aggressive behaviors have been reported in the United

States in connection with alcohol abuse (Aarø et al., 2019). During other catastrophic events caused by man or nature such as war or hurricane, it's been reported that people drank more than usual (Jernigan, 2020). Study in Poland by Chodkiewicz et al (2020), during pandemic period noted that nearly 73% of the respondents consume alcohol, then cigars (25%), followed by some sort of drugs (4%).

From further data in our study, we see that women adopted new methods of food preparation, to larger extent than men, which might be the positive side of pandemic. Although, restaurants only worked part-time, as one of the Government mesaures to reduce the spread of the virus, it did not greatly affect the frequency of food preparation at home. With regard to it, average rate on Likert scale was 3.03, women' 3.05, and men' values 3.

It is evident that eating habits changed to certain extent, and when asked explicitly „ *How much did the outbreak of the COVID-19 pandemic affect your eating habits?* " answers differ, from 1 to 5 on Likert scale, with 2.55 average value; women average value was 2.51 and men' was 2.61. The interesting fact is that during pandemic, male respondents have mostly increased fruit intake, while female respondents have started to consume far more sweats. These results do not come as surprise, Chenarides et al. (2020) in their study reports that from the beginning of pandemic, snack (sweet/salty) intake increased 41.9%. Another study in Italy on "impact of COVID-19 on food consumption", highlights those respondents ate more than usual (46.1%), while 19.5% said they increased body weight (Scarmozzino and Visioli, 2020). Moreover, in the same study increased consumption of sweets (to be specific - ice cream 42.2%) and snacks 23.5% was reported. Negative feelings caused by lockdown, might lead to overeating, usually food containing sugar, salt and fats (Moynihan et al., 2015; Yılmaz and Gökmen, 2020). However, opposite results from Hassen, El Bilali & S Allahyari research (2020), claim that respondents reduced unhealthy foods (snacks), and 28.7% respondents noted decreased intake of sweets.

During lockdown, when most coffee shops and restaurants are closed, most of the people spend their time at home preparing meals (Hassen, El Bilali & S Allahyari, 2020). Research conducted in the USA by Food Industry Association noted that 41% of American citizen spend more time preparing food, 27% of respondents have meal plans, and 20% ate new foods since the outbreak of the COVID-19 pandemic. In the current circumstances, people may find more time for home activities (Hassen, El Bilali & S Allahyari, 2020).

In Tunisia, Jribi et al. (2020) reported better customer behavior when shopping food, during COVID-19 crisis, as well as food waste improvements. This current reported behavior is probably more in connection with economic situation (Jribi et al., 2020). Another interesting survey in Italy by Di Renzo et al. (2020), states that during COVID-19 period, 55% of the respondents cook 30% more unused food at home. According to Hassen, El Bilali & S Allahyari (2020) survey in Qatar, respondents (44.81%) also indicate less food wastage since the COVID-19 pandemic.

Conclusion

The COVID-19 pandemic has further raised awareness of the importance of food safety globally and led to consideration of new measures aimed at protecting people from similar pandemics in the future. In these challenging times, with many unknowns about the new form of the virus, the good news is that there is no evidence yet, that food is a channel for transmission of the coronavirus.

Given the emerging situation, the good hygiene practice, wearing mask and social distance is still considered the best practice to prevent COVID-19 infection. More than ever, special attention is must to food safety, from choosing food, cleaning and disinfecting in proper manner, to right preparation and storage, including application of HACCP and strong adherence to the WHO recommendations and other prescribed measures of competent institutions on global and national level (Government of the Republic of Serbia). The limitation of the research itself, in order to obtain more statistical differences among the respondents, refers to the smaller sample of respondents working in the food and beverage sector, compared to other groups of respondents.

From the research presented in the paper, it can be concluded that during the COVID-19 pandemic, awareness of food safety importance in the Republic of Serbia has increased to some extent, yet it is not in significant correlation to respondents' age. Thus, the research confirmed H1, that the awareness on food safety during COVID-19 pandemic is not related to age.

The research also indicated that the eating habits of the respondents have not changed drastically. However, changes are noticeable with regard to gender - while men mostly increased intake of fruits/fruit products, women on the other hand increased sweats consumption. Also, greater number of female than male respondents accepted new ways/methods of food preparation due to pandemic. With respect to this, the study did not confirm H2, that changes in eating habits during the COVID-19 pandemic do not depend on gender.

In conclusion, food sector professionals in the Republic of Serbia have many challenges ahead, as COVID-19 pandemic is still rapidly spreading, and ensuring food safety is highly important not only to hospitality sector, but households and individuals/general population as well.

It is recommended that further research be additionally focused on food safety and its connection to COVID-19, by examining and detecting SARS-CoV-2 on the places where food is produced, stored and delivered, and with aim of keeping food safe for consumption at all times.

Conflict of interests

The authors declare no conflict of interest.

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INFLUENCE OF RELEVANT FACTORS ON COMPETITIVENESS OF WINE SECTOR OF THE REPUBLIC OF SERBIA

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ABSTRACT

Wine production in the Republic of Serbia has a long tradition and potential for improvement, given the agro-climatic and other conditions. The aim of this paper is to analyze the competitiveness factors of wineries in the Republic of Serbia. The findings show that the wine industry is developing, but its' competitiveness is at a relatively low level. In order to strengthen the competitiveness of the wine sector, it is necessary to define and implement a strategy, which will include activities such as modernization of grape processing technology, new investments and investment in human resources, marketing, winemakers' association and creating a stimulating business climate. Without state support, a significant increase in the competitiveness of wineries cannot be expected. Since interest in wine production has been recently growing, it is to be expected that the wine production, as well as its' export will increase, thus achieving significantly greater economic effects.

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Introduction

The wine industry in the Republic of Serbia is an important economic activity, especially in recent times, given that it shows the potential to encourage the development of agriculture and rural areas, on a sustainable basis.

Wine production and marketing can improve agriculture, provide producers with a more favorable economic position, and consumers satisfaction, because these high-quality products are in demand (Espejel et al., 2008). Wine production in Serbia is at a relatively low level, which annually amounts to about 37.6 million liters, but an optimistic trend of growth has been registered in the recent years (Vlahović et al., 2017). Processing capacities are largely unused, and the optimism is instilled by the fact that more small wineries have been built in recent times, which are trying to position themselves on the market by offering quality and high quality wines with geographical origin.

Strengthening the capacity of the wine industry, i.e. the competitiveness of Serbian wines, has only in recent years become a subject of interest, both for agricultural structures and participants in the value chain, as well as for researchers (Prodanović et al., 2020).

Competitiveness is an indicator of business success, and refers to the possibility of selling products and services in a particular market without difficulty. The competitiveness is practically conditioned by the productivity and can be increased by applying new knowledge, technologies, investments and increased efficiency (Ignjatijević et al., 2018).

The market of the Republic of Serbia is characterized by the offer of domestic as well as imported wines, since the domestic wines cannot meet the growing demand. The growing supply and demand of wine imposes the task of creating and implementing a strategy to strengthen the competitive position of domestic wineries, which is an important prerequisite for strengthening wine capacity.

The improvement of the market position of domestic wines, i.e. the growth of the competitiveness of wine capacities, can be realized by increasing the quality of input raw materials and the processing technology itself. In this regard, we emphasize that there is a trend of modernizing the technology of grape and wine production, the introduction of quality vine cuttings and the purchase of modern equipment in wineries. This trend should be maintained aiming to change the structure of wine production with agricultural policy measures, which will be based on scientific principles and new technologies.

Raising the competitiveness of the wine industry would improve the market position of economic entities and individual agricultural holdings, which are engaged in the production and marketing of wine. For the Republic of Serbia, as well as for all countries with relatively small market potential, the international market is a real indicator of competitiveness, because it is much larger than the domestic market and thus crucial to their development. Therefore, the analysis of the competitiveness of domestic wines relies on imports and exports.

Methodology and data sources

The research is based on a review of scientific and professional literature, and uses general scientific methods, while as specific methods and tools we emphasize relevant economic indicators and compound annual growth rate (CAGR).

For the needs of the analysis of the competitiveness of domestic wine capacities, the methodological solution "Porter's diamond model" is used, where the general business conditions are specially analyzed. Porter discusses the issue of competitiveness by posing the question of the reasons for the international success of companies located in certain countries and regions (Porter, 1990). According to Porter, the characteristics of the environment in which companies operate represent the most important deciding factors of competitiveness:

- factor conditions;

- strategy, structure and rivalry;

- demand conditions;

- related supporting industries.

The research used a database on international trade in wine. The data were taken from the Republic Statistical Office, the database of the World Trade Center and include ten-year data series, starting in 2010.

Aim of the paper

The aim of this paper is to investigate all relevant factors that determine the level of competitiveness of the wine sector of the Republic of Serbia. The main research question is as follows: is the competitiveness of the wine sector of the Republic of Serbia satisfactory, i.e. is there a possibility of strengthening the competitiveness of domestic wines, as a basic precondition for strengthening its' production capacity?

Therefore, the research of the competitive position of wine producers from the Republic of Serbia aims to define the preconditions for formulating a successful strategy for improving competitiveness, ie strengthening the capacity of the wine industry.

General conditions for the growth of the competitiveness of the wine industry of Serbia

Wine production in the Republic of Serbia is mainly based on family wineries of small and medium capacity. The main reasons for the relative lag of this sector, which determine the low competitiveness and productivity of grape producers and processors, are the small areas under vineyards, ie the lack of economies of scale, modern equipment and technology (Prodanović et al., 2020). Wineries with a larger volume of production also have a higher level of competitiveness (economies of scale). In addition to professional education, wine producers have at their disposal counseling, seminars and other types of education. Most small producers hire family members to carry out all business

activities. The technology of grape processing and wine production is gradually being improved, quality equipment for processing and storage is being procured (Jakšić et al., 2015), which contributes to the growth of competitiveness. Still, one of the main reasons for the slow growth of the wine industry is the modest investment in people, i.e. the orientation towards investments in the physical factors of production. Research shows that an increasing number of wineries use state subsidies, and invest primarily in the purchase of new machines and equipment. Given the low level of production and the current state of equipment of wineries, on the other hand, growing demand, the need for significant investments is expressed. Financing conditions have not changed significantly and winemakers are of the opinion that the capital is still unavailable due to the high cost of capital and complicated loan approval procedures.

In the period after 2000, with the opening of the market, the preconditions for strengthening competitiveness have been created. The opening of the market was supposed to encourage the application of innovations and new technologies in production. However, most producers, pressed by financial difficulties and lack of working capital, did not invest significantly in new technologies. The current situation of the wine industry is tolerable (Denda and Denda, 2016; Prodanović et al., 2020), and a significant improvement in the production process is expected.

In the last two decades, the wine sector has achieved a noticeable growth trend in demand, thanks to changes in the habits of consumers, who increasingly consume quality wines, but also thanks to promotion through specialized fairs and traditional events (Pivac et al., 2015).

In a study by Vlahović et al. (2017) almost half of the respondents (45%) do not differentiate between domestic and foreign wines, i.e. they consume both equally. The level of demand for domestic wines is not stimulating enough to increase production. As domestic wines have has a dynamic introduction of on the market only in the last two decades, it is clear that we cannot talk about products that have a strong position in the minds of consumers.

Many wine producers enter the market independently, which is why they do not achieve adequate sales prices, nor do they ensure the security of placement, which cannot, as a rule, result in high efficiency. In this regard, the association of wineries in cooperatives is imposed as an economically rational activity. Associations should provide stimulation of wine production, influence the exchange of ideas and experiences, cooperation with state institutions, in one word, to ensure the strengthening of competitiveness (Prodanović et al., 2020; Cvijanović and Ignjatijević, 2020). Within clusters, cooperatives and associations of producers, the existing competitive advantages (labor and natural resources) would be better used, and also cooperation with institutes and other scientific and educational institutions would be more accessible (Paraušić and Cvijanović, 2014; Ignjatijević and Cvijanović, 2017). The association of wineries would enable more effective wine promotion and a better reputation for wineries, which is essential for production growth (Jević et al., 2019).

The role of the state in increasing the competitiveness of the wine industry is directly related to the policy of economic development, and is reflected primarily in the creation of favorable general conditions for business and proper functioning of the market (Marinković et al., 2016; Cvijanović et al., 2020). Based on that, mutual competition of wine producers on the market in regard to attracting consumers, finding the most efficient production processes and lowering prices, can be organized most efficiently in free market conditions, which guarantee that producers will have equal conditions and the pre-known "rules of the game" (Đurić, 2015). The state should provide equal conditions for all market participants and market laws will accept or reject participants depending on their abilities (Crampton, 2002). The state should build and improve institutions, which will stimulate the growth of competitiveness. The creation of institutions is preceded by legislation, which will clearly define the rules of conduct and clear procedures while building a judicial system, which will enable compliance with these measures, and quickly and effectively sanction their non-compliance. At the same time, domestic rules, which are not in accordance with European (international) regulations and standards, should be harmonized. Given that the legislation and standards are fully harmonized, activities should be focused on innovating the zoning of viticultural production, as well as the proper distribution of budget funds by vineyard areas, respecting the regional location and geographical origin (Pivac, 2012). In this context, measures and instruments of the European Union (hereinafter: EU) Common Agricultural Policy, ie regulations concerning viticultural production and the wine sector, are of primary importance.

We cannot be completely satisfied with the institutional framework and the role of the state in increasing the competitiveness of the wine industry, given that legislation and competent institutions still lack capacities for pursuing more significant actions (Leković, 2016). The new Strategy of Scientific and Technological Development of the Republic of Serbia (2021 - 2025) emphasizes the strengthening of institutions, innovation, knowledge and new technologies, which is a prerequisite for the growth of competitiveness of the economy, and thus the wine industry.

The state should support those productions for whose products there is a demand, such as e.g. production of high quality indigenous wines. The unemployment rate in the Republic of Serbia is relatively high (10.9% in 2019), especially of young people in rural areas (20.7% in 2019), which is significantly higher compared to the European Union, where the unemployment rate is 6.4% (Strategija zapošljavanja u Republici za period od 2021. do 2025). In this context, reducing unemployment through support for specific programs in agriculture, such as grape and wine production, is necessary and completely justified.

Competitiveness factors of wine producers

The importance of the wine industry in the Republic of Serbia and the analysis of its' competitiveness can be observed through the fact that, in the recent period, it has achieved a mild growth.

The principle of production efficiency can be equated with competitiveness (Dresch et al., 2018). Wine producers must be trained in regard to production operations, where opportunities to increase productivity and competitiveness are greatest. This increase should be based on the segment of continuous increase of wine quality, improvement of production technology or raising production efficiency. Most of the wine capacities are located within individual agricultural holdings and their strategy of conquering new technologies is crucial for developing competitiveness. Experience shows that in small agricultural holdings, the implementation of new technologies is slow, therefore the incentives are needed (Yigezu et al., 2018).

Technology as a factor in the competitiveness of the wine industry

Technology should be cited as a key factor in establishing a better competitive position for the wine industry. Namely, the opening of the market led to an increase in competition, but this growth is at the expense of the participation of basic factors, not technology, as is the case in EU countries (Vukajlović and Ćurčić, 2016). It happens exactly that the imported wines with low technology are competitive in the domestic market. The economic climate in the past period did not sufficiently encourage the introduction of new technologies. The Republic of Serbia lags behind technologically, but the interest of medium and large economic entities in the application of new digital technologies has been expressed (USAID, 2019). Also, it points out importance of efficient technology transfer in Serbia for further development (Mosurović Ružičić et al., 2015).

The institutional framework and the role of the state do not encourage the introduction of new technologies to the desired extent. It is necessary to define and implement an appropriate technological strategy, in order to maintain and increase the competitiveness of the wine industry.

Stimulating research and development projects can contribute to strengthening the competitive position of the wine industry, and implies a special role of the state (eg direct subsidies or tax relief), because wineries do not posses enough knowledge for such activities. The state still does not allocate enough funds for research and development. Furthermore, we estimate that the wine industry will not be able to invest significantly in research and development of technologies in the near future, so competitiveness will not increase very much.

Monitoring the so-called discovered comparative advantages in wine production

«Revealed Comparative Adventage» - RCA represents the ratio of the foreign trade balance and the total volume of trade. The value of this indicator is expressed as a percentage and observed from year to year, shows an increase or decrease in competitiveness (Božić and Nikolić, 2016). For example, in 2010, the foreign trade balance of wine amounted to -21,274,400.00 $, and in 2011 it has decreased to -20,610,200.00 $ and has maintained the decreasing trend during the observed period. It

is especially indicative that the negative foreign trade balance has significantly decreased in the last two years of the observed period, which represents a positive trend. In 2019, the foreign trade balance of wine amounts to - 9,966,400.00 $ (Table 1). The value of RCA during the analyzed period shows that compared to 2010 (13,176,700 $) there was an increase in exports, and thus the competitiveness of wine in foreign markets.

At the beginning of the observed period (2010-2012), there was a sharp increase in the value of wine exports, and then a decline in exports until 2016, but a disproportionate increase was again recorded in 2017 (Table 1). On the import side, the value has decreased slightly since 2011, when it amounted to almost $ 38 million, but in 2016, the wine imports have increased again. Despite significantly higher imports compared to exports, the data on the trend of slight growth of wine imports since 2016 is of high concern.

The average value of wine exports from the Republic of Serbia is $16,688,950, and imports of $33,853,400. Data on foreign trade of wine (Serbia - World) show that in the observed period there was an increase in exports at a rate of 5.65%, and imports at a rate of - 0.96%, i.e. imports recorded a slight decline, which is optimistic. The analysis of the exported quantity of wine indicates further possibilities for export growth.

The price of wine in exports varies and in 2019 averages $1.55/l, which is significantly higher than the average for the observed period ($1.36/l).

Table 1. Foreign trade of wine Serbia - World (2010-2019)

Year		Export	Import	Foreign trade balance	Average export price ($/kg)	Average import price ($/kg)	Coverage of import by export (%)
2010.	Quantity, in t	11,325.10	28,459.00				
	Value in 000 USD	13,176.70	34,451.10	-21,274.4	1.16	1.21	**38,25**
2011.	Quantity, in t	15,419.00	29,959.70				
	Value in 000 USD	17,306.60	37,916.80	-20,610.2	1.12	1.26	**45,64**
2012.	Quantity, in t	23,510.30	30,803.40				
	Value in 000 USD	21,209.90	35,333.30	-14,123.4	0.90	1.15	**60,02**
2013.	Quantity, in t	12,469.50	24,574.60				
	Value in 000 USD	17,116.70	33,634.50	-16,517.8	1.37	1.37	**50,89**
2014.	Quantity, in t	11,976.40	25.788.70				
	Value in 000 USD	17,026.50	33,433.50	-16,407.0	1.42	1.30	**50,93**
2015.	Quantity, in t	10,595.30	25,055.50				
	Value in 000 USD	14,297.30	28,351.20	-14,053.9	1.35	1,13	**50,43**
2016.	Quantity, in t	9,881.00	29,395.20				
	Value in 000 USD	14,922,90	30,265.60	-15,342.7	1.51	1.03	**49,31**

Year		Export	Import	Foreign trade balance	Average export price ($/kg)	Average import price ($/kg)	Coverage of import by export (%)
2017.	Quantity, in t	12,184.50	26,781.40				
	Value in 000 USD	19,465,60	30,771.80	-11,306.2	1.60	1.15	**63,26**
2018.	Quantity, in t	12,769.60	22,465.40				
	Value in 000 USD	21,228,10	31,838.90	-10,610.8	1.66	1.42	**66,67**
2019.	Quantity, in t	13,990.60	22,263.50				
	Value in 000 USD	21,610,00	31,576.40	-9,966,4	1.55	1.42	**68,44**

Source: Statistical Office of the Republic of Serbia

During the entire period that has been analyzed, the Republic of Serbia imports significantly more wine than it exports. In 2019, 22,263,500 liters were imported, for which $31,576 40 has been spent. The import price of a liter of wine was $ 1.42/ l, so it can be concluded that we import wine at a slightly lower price compared to the export price. The lower import price is the result of a lower share of technology (added value) in the selling price. This implies that domestic wine is potentially competitive, but it should diversify the offer, enhance marketing activities (promotion, packaging, etc.), in order to achieve an even higher price in exports. Aguglia and Salvioni (2010) point out that the export-oriented producers should focus on direct marketing, thus achieving higher prices.

The coverage of imports by exports is at a relatively low level. The highest coverage rate was recorded in 2018 and 2019, when exports were covered with 66.67% and 68.44%, respectively. In other words, the import quantities of wine are significantly higher in relation to the exported quantities, which indicate the non-use of potentials and resources at our disposal, but also other factors, such as lack of branding and adequate marketing strategy.

In 2019, the Republic of Serbia achieved a record value in wine exports of 21.61 million dollars (Table 1). Compared to 2008, the value of exports has doubled. The growth trend of wine exports was also recorded in 2020, so a new annual record can be expected (Zdravković, 2020).

The import of wine to the Republic of Serbia was worth 31.5 million dollars in 2019 and was slightly lower than in 2008 ($32.4 million) (SORS, https://data.stat.gov.rs).

The deficit in the foreign trade balance of wine can be partially reduced based on the increase in production and exports of small wineries. The wine tourism has the potential to offer indigenous wines and local specialties, and can contribute to the recognition of the wine region and indirectly to the improvement of the wine sector (Erdelji and Lajko, 2015; Pivac et al., 2015). Wine routes have been designed for effective promotion and easier sale of wine (Brščić et al., 2010; Jovanović et al., 2015). The wine route consists

of natural beauties, cultural and historical sights, traditions and peculiarities of the wine-growing area (Pivac, 2008).

The SAA (Stabilization and Association Agreement) and CEFTA (Central European Free Trade Association) agreements enabled the placement of wine on the European market, but due to the long-standing crisis in the viticulture and winemaking sector, the Republic of Serbia cannot respond to the demands of these markets.

The analysis of the data shows that the total wine turnover of the Republic of Serbia with the EU averages $ 10,323,860.00 per year, of which exports account for 27.00%, or $ 2,786,990.00 (Table 2). We can conclude that the EU is an important trade partner when it comes to wine and that the Republic of Serbia has an extremely negative trade balance, which is probably the result of imports of high quality wines, while on the other hand, it exports lower quality wines with a smaller share of technology.

The Republic of Serbia had the largest volume of wine trade within the CEFTA market, where the majority of import wine originates (Ministarstvo poljoprivrede, šumarstva i vodoprivrede – MPŠV RS, 2019).

According to the SORS for the period 2012-2018, a positive foreign trade balance was achieved with the countries of the EU in terms of quantities (798,100 l), but a negative average annual balance in terms of value (3,384,700 euros) of wine. It is indicative that the average export to the EU market in the observed period was 2,733,000 liters (with an average annual value of 1,935,560 euros) and the average annual import was 1,935,000 liters (with an average annual value of 5,167,260 euros) (SORS, 2012-2018).

The export of wine to the EU market is regulated by quotas in the SAA and is set at the level of 63,000 hectoliters per year, which is currently above the capabilities of the Republic of Serbia (Erdelji and Lajko, 2015). This speaks in favor of the fact that domestic wines do not contain additional value, and as such cannot achieve a high price.

Table 2. Foreign trade of wine Serbia - EU (2012-2019)

Year		Export	Import
2012.	Quantity, in t	14,104.50	2,248.20
	Value in 000 USD	8,432.90	7,480.60
2013.	Quantity, in t	2,062.20	2,013.10
	Value in 000 USD	1,929.00	7,997.10
2014.	Quantity, in t	572.10	1,986.40
	Value in 000 USD	1,456.20	7,065.40
2015.	Quantity, in t	603.80	2,009.80
	Value in 000 USD	1.457.90	6,312.20
2016.	Quantity, in t	485.70	1,933.50
	Value in 000 USD	1,373.90	6,326.30
2017.	Quantity, in t	899.10	1,767.80

Year		Export	Import
	Value in 000 USD	1,777.10	6,512.20
2018.	Quantity, in t	1,410.70	1,949.20
	Value in 000 USD	2,051.50	8,342.20
2019.	Quantity, in t	1,496.70	3,074.70
	Value in 000 USD	2,488.30	10,259.00

Source: SORS

The basic assumptions of product competitiveness are (Živkov et al., 2012):

- If the value of exports of a product is significant or higher than its'competitors', there is potential for growth in the competitiveness of that product;

- If the trend of export growth is faster than from its' competitors, there are significant positive trends in the competitiveness of domestic product.

Table 3. Participation of Southeast European countries in foreign trade in wine in 2019 (in $ 000)

SEE countries	Export	Import
Albania	1,104	11,600
Bosnia and Herzegovina	4,023	19,202
Northern Macedonia	51,831	1,099
Serbia	20,895	30,804
Montenegro	13,332	8,493
Total SEE countries	**91,185**	**71,198**

Source: World Trade Center

The countries of Southeast Europe are wine exporters primarily thanks to Northern Macedonia and Montenegro. This indicator speaks enough on the competitiveness of wine producers, where the Republic of Serbia ranks only third in the region, which classifies it as a net importer of wine.

Wine quality as a factor of competitiveness

Numerous factors determine the quality of wine, and the variability of quality limits the possibility of participating in the international market. Wines with a geographical indication create a belief among consumers that these are products of specific quality and taste, for which they are willing to pay a higher price (Đekić and Jovanović, 2010). Quality, which is confirmed by geographical, ecological or some other label, is completely in trend, so consumers are increasingly buying such products (Živkov et al., 2012). In the last decade, wines have been protected through a geographical indication, which contributes to the development of viticulture and the wine industry, as well as the image of certain geographical areas. Branding through a geographical indication directs the customer to a specific area, as well as the specifics of individual wines, which allows the producer to gain the trust of customers, achieve better placement and higher prices. Dogan and Gokovali (2012) point out that the geographical indication

helps small producers to differentiate their indigenous product and thus achieve a competitive advantage.

In theory and practice, the importance of non-price factors of competitiveness is emphasized and there is no divergence of opinions (Gagović, 2016). The basic question that arises is how to measure competitiveness by quality.

The quality indicator in foreign trade is the unit value of the product (*UV value*), defined by the ratio of the value of exports, i.e. imports, to a unit of measure (usually kilograms). Using this indicator, it is possible to compare it with other countries, and thus determine the relative position (Branković and Baranenko, 2014).

The higher unit value of exports indicates the fact that a specific country (Božić and Nikolić, 2016):

- offers higher quality products, i.e. products with a higher content of added value;
- specializes in high priced products;
- sells an identical product at a higher price, due to higher managerial and marketing skills of exporters.

For the period 2010-2019, the average UV export of wine from the Republic of Serbia is 1.36 $/l, while for imports it amounts to 1.25 $/l (Table 1). This indicator shows that, on average, lower quality wine is imported rather than it is exported.

The value of wine exports grew in the observed period and recorded the maximum value in 2019 ($ 21,610.00) (Table 1), which instills optimism that the growth trend of exports will continue. The decline in the value of exports after 2014 is probably the result of unfavourable weather conditions, i.e. lower production in that year.

The value of wine imports in the observed period (2010-2019) was the lowest in 2015 ($ 28,351,200.00) (Table 1), but significant growth in imports was achieved again in 2016. This could be explained by the fact that cheaper wine is imported, given the relatively higher quantities in imports and the slightly lower average price in relation to the export price.

Research shows that the correlation between the GDP and exports is somewhat smaller if exports grow due to low costs, and it is higher if exports grow due to higher quality (Stojanović, 2018). Đurić (2015) points out that in the long run, domestic producers cannot count on competitiveness with low costs, based on cheap raw materials and labor. In this context, only increasing and maintaining wine quality can lead to higher exports.

The competitiveness in quality exists if higher product prices lead to higher exports (price elasticity), which is the case with our wine. The price in the observed period increased from $ 1.16 from 2010 to $ 1.55 in 2019, and at the same time there was an increase in wine exports.

Price competitiveness of domestic wines

Price competitiveness prevails if, while maintaining lower prices, exports increase. Based on the comparison of price and quantity movements, changes that have occurred over time can be analyzed. Export markets can be segmented into those dominated by quality, on the one hand, and markets dominated by prices, on the other (Vehapi, 2018). Thus e.g. in markets that seek quality, we will offer high quality, while in those markets where price is important, we will offer a product in various price categories, favoring a slightly lower price. Considering that the export of wine to the EU market, where quality is quite important, is not easy and the quantities in question are many times smaller than the import quantities, we can conclude that our wines are not competitive on the EU market in terms of quality. We also export wines to the EU at a significantly lower price than we import. Let's just give an example from 2019, when we exported wine at an average price of $ 1.66/l (1,496,700 liters), and imported $ 3.37/l (3,074.70 liters).

So, one of the reasons that limits the greater realization of wine is the price. Given the relatively lower standard of the domestic population, the high price, regardless of the fact that it implies higher quality, can be an obstacle to greater purchase of these products, and thus to the growth of competitiveness of producers. This is less characteristic of export markets.

In addition, the success of a low prices strategy, i.e. lower production costs, can produce results only if wine producers can maintain low product prices in the long run (Aguglia et al., 2010; Zarić et al., 2014). Competitive strategy focused exclusively on low prices gives good results only if wineries define target group of customers, for whom price is the most important feature of the product and who are willing to sacrifice all other attributes, such as quality, packaging, taste, geographical origin etc. (Tanwar, 2013; Zarić et al., 2014).

Competitiveness can be expressed by the ratio of quality and price of a particular product. The higher the coefficient, the more competitive the product will be (Đekić and Jovanović, 2010).

Conclusion

The main reasons for the slower development of the wine sector, which determine the low competitiveness and productivity of wine producers, are the lack of economies of scale, modern equipment and technology. Wine production is mainly based on family wineries of small and medium capacity, most of which do not use modern technologies for wine processing and storage, which makes it difficult to achieve and maintain a desirable competitive position. In addition, the analysis of the competitiveness of domestic wines has shown:

By way of monitoring the so-called revealed comparative advantages in wine production a slight increase in the competitiveness of the wine industry has been shown, especially in recent times, because the negative foreign trade balance of wine decreased for the

observed period 2010 - 2019. Data on foreign trade in wine show that in the observed period there has been an increase in exports at an average annual rate of of 5.65%, while imports fell at a rate of 0.96%.

- We analyzed the quality of wine as a factor of competitiveness through the unit value of the product (UV). For the observed period, the average UV export of wine is 1.36 $/l, while for wine imports it amounts to 1.25 $/l. This indicator shows that on average, wine of slightly lower quality is imported, compared to exports. Given that the export of wine to the EU market is quite modest, where quality is sought, we can assess that our wines quality is not competitive in that market. As all relevant research shows that exports are growing thanks to higher quality, further increasing and maintaining wine quality is a priority.

- Price competitiveness exists when a rise in product prices leads to higher exports, as is the case with our wine. If we focus on the EU market again, then we certainly do not have price competitiveness, because export prices are significantly lower than import prices of wine in the period after 2013.

Strengthening the capacity of the wine sector, i.e. raising the competitiveness of wine producers, includes:

- agricultural policy measures that will encourage the introduction of modern equipment and technology in the production and processing of grapes, as a key factor in ensuring the quality of wine and achieving better economics in business, as well as the dissemination of the latest scientific knowledge;

- marketing activities, and especially branding of domestic wines through the introduction of geographical indications and on that basis better market positioning.

In addition, in order to increase the competitiveness of wine capacities, it is necessary to harmonize the interest of the public and private sector, define and implement a strategy to strengthen the competitiveness of the wine industry, which will focus on investment in research and development, support for small producers through a system of subsidies, education, association of producers and financing of production. Quality standardization has been recognized as an important factor in the growth of the competitiveness of the wine sector. With adequate marketing and strengthening the competitiveness of domestic wineries, significant benefits can be expected in the future.

Without stronger state support, no significant growth in the competitiveness of the wine industry can be expected. Greater support in terms of improving the business climate, co-financing projects, introducing innovations is expected in the future period from the agricultural budget, but also through EU technical assistance programs in the accession process.

Since the number of wineries in the Republic of Serbia has recently increased, it is to be expected that the production of grapes and wine, as well as exports, will increase, and thus achieve significantly greater effects.

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Conflict of interests

The authors declare no conflict of interest.

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ATTITUDE OF EMPLOYEES ON THE APPLICATION AND SIGNIFICANCE OF HACCP SYSTEM IN RURAL TOURIST HOUSEHOLDS IN SERBIA DURING COVID-19

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A R T I C L E   I N F O

A B S T R A C T

Diseases caused by food consumed in restaurants during a pandemic, can cause enormous damage and lead to closure of rural households. The aim of the research was to determine the attitude of employees in rural households on the application and importance of doing business according to the HACCP (Hazard Analysis and Critical Control Point) food safety system in 47 rural tourist households in Serbia during the COVID-19 pandemic. A structured field survey questionnaire was conducted on a sample of 286 employees. The generated data were processed by the statistical program Statistica 14.0. The obtained results show that the application of HACCP food safety system during the pandemic was highly appreciated by the employees and that operating according good hygiene practice (GHP) and good manufacturing practice (GMP) fully meets all safety requirements and the extent to which employees in rural households must be aware of and be instructed in its application.

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Introduction

Hospitality activities in rural households are very complex and specific, in terms of introducing sustainable systems and procedures related to food safety and quality, given the different dynamics of the process of preparation, production, storage and serving of food (Chen et al., 2020). According to the data of the Republic Bureau of Statistics, in the Republic of Serbia, rural tourism as an activity is recognized in 50 villages with about 3.000 beds (Gajić et al., 2018). About 85% of the total territory of Serbia is occupied by rural areas where over 40% of the total population lives. There are 4.709 settlements in Serbia, i.e villages (according to the Constitution, there is no category of villages), and 1.200 are in the phase of disappearance, which has less than 50 inhabitants (Gajić et al., 2018; Cvijanović & Gajić, 2021). Consumers have a right to expect their food to be safe, of good quality and fit for consumption. In that sense, food safety and quality on the international market are of great importance. Properly planned, managed, financially monitored and implemented HACCP system, is a model that will contribute to the safety of service users, improve their health, and thus customer satisfaction (Trafialek & Kolanowski, 2017). In the Republic of Serbia, the Law on Food Safety (Official Gazette of RS, 41/2009 and 17/2019) and the Rulebook on General and Special Conditions of Food Hygiene at Any Stage of Production, Processing and Trade (Official Gazette of RS, 72/2010 and 62/2018), defines that all entities in the food business must establish a system for ensuring food safety, in accordance with the principles of good production and hygiene practice, and hazard analysis and critical control points (HACCP). The application of HACCP system in rural catering in relation to the food industry is related to the fact that the key difference is the existence of a large number of input and final products, numerous complex recipes, technology of individual production of different products in a small space and additional food serving (Aleksić et al., 2020, World Food Programme, 2020). Rural catering is specific in terms of providing healthy food, which would achieve a high level of quality (Gajić et al., 2020a). The COVID-19 pandemic that emerged in 2019. imposed enormous consequences, including economic losses and threats to human health, which continue to affect many aspects around the world (Han et al., 2021). The Food and Agriculture Organization (FAO, 2020) stated that COVID-19 affects agriculture in two key ways, in terms of food supply and demand, which are directly related to food safety (Gossling et al., 2020). The food supply chain is a link that connects agricultural systems with end consumers of food through processes related to production, packaging, distribution and storage (Quevedo-Leon et al., 2020). Similar research on food safety during the COVID-19 pandemic was conducted worldwide in 2020 (Xiang et al., 2020). In their research, entitled *Impacts of the COVID-19 pandemic on consumers food safety knowledge and behavior in China*, they developed an econometric model technique for assessing knowledge and behavior about food safety of residents. The results of a survey conducted on a sample of 1.373 people in China show that residents who focus on food safety information also practice different behaviors regarding proper nutrition. Further, they point out that the COVID-19 pandemic improves food safety knowledge and influences behavior, while the focus on available food safety information is an important

mechanism for improving behavior. Also, in all facilities of their research, the application of the food protection and safety system was at a high level (Xiang et al., 2020).

The obtained results can contribute to the social and scientific research sector, when it comes to COVID-19, and its mode of transmission, as well as the identification of all strategic measures to combat pandemics in food and accommodation facilities. If each country achieves similar results, a shift could be expected, at least in the domain of understanding that COVID-19 is not transmitted through food if all Safety System measures are implemented. The practicality of the research can also be of fundamental importance, in order to acquire new knowledge about the business system in food safety in rural households, and the effective fight against the penetration of the pandemic through this area. The significance of this paper is reflected in the contribution of the results from the area of Serbia, because there is no similar research on a given topic from this area. The limitations in the research were certainly related to the social distance and approach, as well as the will of the respondents to fill in the surveys, as well as, of course, the limited working hours of the catering facilities. The main limitation of this and similar research is the absence of universally defined indicators and parameters that describe individual components of HACCP implementation policy in rural households.

Literature review

Some of the characteristics and consequences of Covid 19 on the tourism and hospitality sector

COVID 19, appeared suddenly and crashed all over the planet (Carlos et al., 2020). About 50.000 people have lost their jobs in Serbia since March 2020. Predictions are, and it is now quite certain, that economic growth everywhere in the world will be significantly lower than planned (Gajić et al., 2020a; 2020b). Some branches of the economy are extremely hard hit and the question is how long it will take them to recover. In such a new situation, the only logical solution was to close a large number of hotels in Serbia, because due to low demand, it is not rational to keep the employed infrastructure, when variable costs are significantly higher than current business inflows (Cvijanović & Gajić, 2021). The facilities were preserved in the second half of March, workers were sent on collective vacations, and shifts were organized, which supported the measure of social distancing. First of all, the drop in traffic this year alone by 55% to 70%, in hotels brings with it a large drop in non-board consumption. Currently, according to the data from the last quarter of 2019, about 83.140 employees work in the hospitality industry in Serbia, and as a consequence, we can expect a drop in employment of 60% with an additional drop in average salaries of 35% (Cvijanović & Gajić, 2021).

Food safety and COVID 19

Based on current knowledge and risk assessment regarding the outbreak and spread of coronavirus disease (COVID-19), there is no evidence to suggest that the virus is transmitted through food, as the host (human or animal) is required for coronavirus transmission (Qui et al., 2020; Lin et al., 2020). The primary ways in which the virus

is transmitted is from person to person, close contacts, as well as staying in a space with a large number of people (Abudllah et al., 2004; Pine & Mckercher, 2004). Corpet (2021), in his research claims that SARS, stays on the carton for 24 hours, two days on stainless steel and three days on polypropylene (plastic). Traces of the Corona virus were reportedly found in China on packages of frozen shrimp and chicken wings imported from South America (Assaf et al., 2020; Du Bois, 2020). The question of whether the Corona virus is transmitted through the packaging of frozen food has once again come to the public's attention (Elgin et al., 2020). The demands of today's buyer of a rural tourist product are increasing, and they are especially expressed in terms of food safety (Ahuja & Sicherer, 2007). In the dynamics of the product finalization process, a high frequency of health risks is expressed. Namely, there is a large number of products and processes that are performed during food preparation and where the food comes into contact with various equipment and surfaces, with an emphasis on the constant presence of employees who manipulate food (Dzwolak, 2017). HACCP (Hazard Analysis and Critical Control Points) is a food safety system based on the analysis and control of potential biological, chemical and physical hazards to which raw materials are exposed, possible hazards during handling, production, distribution and consumption of the final product (Taylor, 2008; Fotiadis et al., 2021). Fresh agricultural products in rural households are grown, not always, in hygienic environments, and people, water and animals are the main dangers in agriculture (Bas et al., 2007; Baker et al., 2020; Popov-Raljić & Blešić, 2021). A special danger is created with fresh products, which are considered in rural households as organic, which do not go through further processing (Kampf et al., 2020). The modern approach to food safety is a comprehensive system of so-called food safety chain "from field to table" based on risk analysis (Hecht et al., 2019; Principato et al., 2021). Rural tourist households as well as other catering facilities, have a key role to play in ensuring adequate application of applicable regulations and producing food that does not endanger the health of consumers (Gibson et al., 2012). Among the legal changes in 2009, the Republic of Serbia introduced a new Law on Food Safety (Official Gazette of RS, 41/2009 and 17/2019) which requires the application of a food safety system based on the principle of hazard analysis of critical control points (HACCP -Hazard Analysis and Critical Control Point) for all entities in the food chain except primary production.

Olaimat et al., (2020), in their study entitled Food Safety During and After the Era of COVID-19 Pandemic, claim that there is no specific data on the retention of Covid virus on food packaging, except for other viruses and bacteria. They further point out that the implementation of food safety management systems such as Hazard Analysis and Critical Control Points (HACCP) are very important in reducing the risk of Covid infection. Jawed et al., (2020) point out that HACCP-based nutrition systems are not as effective as desired in reducing pandemic risk. They also argue that other elements should be added to the HACCP food safety system: food safety, food quality, food defense and food fraud. They suggest changes in the food safety system. regulation on food hygiene (852/2004) specifies the obligation to set up an HACCP plan in

one's company to fight against consumer-related hazards. The HACCP plan must be regularly updated, for example, in response to changes in recipes or processes. The current context has led businesses to review their HACCP plan(s). The HACCP plan is one of the elements of the SCP (Sanitary Control Procedures). Its update is not a regulatory obligation. It is a choice of the company, but it is necessary in the context of the Covid-19 crisis (Guide 2020 edition - COVID-19 update).

H1: Employees in rural households or hosts consider there is no difference observed in application of HACCP food safety system principles, before and during the Covid-19 pandemic.

H2: There is no statistically significant difference in the application of the Food Safety System in rural households that are HACCP certified, and those that do not have a certificate.

H2a: There is a statistically significant difference in the application of the Food Safety System in rural households that are HACCP certified, and those that are not certified.

H3: There is a statistically significant difference in operations of rural households that apply only GHP and GMP, from those that have HACCP certification.

H4: There is a statistically significant difference in the attitudes of the respondents about the influence of the responsible person on the application of HACCP.

Methodology

Sampling During 2020, for 5 months (from June to October), a field survey was conducted using a modified structured survey questionnaire (Ahuja & Sicherer,2007; Sharma, 2011; Soon, 2018) on a total of 286 respondents who were employed in 47 rural tourist households in rural areas of Serbia (in Vojvodina - 18 households, Central Serbia - 10, Western Serbia -12 and Eastern Serbia - 7). The structured questionnaire contained two parts, where the first part included a demographic description of the respondents, while the second part contained questions related to the implementation and views on the HACCP food safety system in rural tourist households during the Covid-19 pandemic. The authors of the paper went to the field, to rural households and whitewashed their answers. Some household owners, or employees, completed the questionnaires themselves, while the authors took care to reduce ambiguities during the survey, in order to obtain complete answers.

Instruments

As stated, a modified questionnaire was used. The questions were asked and evaluated on the basis of a five-point Likert scale (with grades from 1- strongly, 2 – disagree, 3- undecided, 4 – agree, 5- strongly agree). The obtained results were statistically processed using the statistical program Statistica 14.0 (Dell Inc., 2020). Dell Statistica is a general purpose analytics work bench that allows users to access, prepare, analyze, report and deploy advanced analytical models within vendor agnostic

environments. Statistics 14.0 is a major release, with new features and functionalities, better performance and an interface (Soon, 2018). Descriptive statistical analysis is presented, which usually precedes statistical inference and prediction, but can also be the ultimate goal of statistical analysis. Depending on the target group of subjects, they were analyzed using the χ2 (chi-square) test to determine the statistical significance of differences between the distribution of respondent responses. In the processing of the obtained data, the standard measure of central tendency - arithmetic mean (Xsr), measure of variability - standard deviation (Sd), distribution asymmetry coefficient - skewness (Sk), distribution form coefficient (flatness or elongation) - kurtosis (Ku) were used. Since all variables are normally distributed, parametric statistics methods were used. The marginal level of statistical significance is expressed at the level of probability 0.05. Generally speaking, the instrument shows satisfactory measuring characteristics. Reliability was determined by the Crombach alpha coefficient. The internal reliability of the questionnaire used is 0.80 (Krombach's alpha coefficient α = 0.897, with standardization α = 0.873). The obtained values of the standardized skewness and kurtosis indicators are in the ranges of acceptable limit values asymmetry <| 1 |; homogeneity <| 3 |), which indicates that adequate parametric methods can be applied in the processing of the results.

Results and Discussions

In terms of demographic indicators, it can be stated that in the sample, despite a slightly higher share of women among respondents compared to men (55% vs. 45%), respondents of both sexes were evenly represented. In terms of age, the survey predominantly (over 90%) included respondents of younger age categories (up to 45 years), while the share of those older than 45 years is slightly above 7%. The obtained data indicate that a negligible number of respondents with completed primary school participated in the survey, the most represented were respondents with completed secondary school (50%), and a significant share of respondents with completed higher education or academic studies (42%). The share of respondents with completed postgraduate studies is relatively small (7%). The sample has a dominant share (over 80%) of facilities engaged in organic production and food and beverage services. Food business operators are obliged to establish a food safety system at all stages of food production, processing and trade, except at the level of primary production, in accordance with the principles of Good Manufacturing Practice (GMP) and Good Hygienic Practice - GHP) and hazard analysis and critical control points (HACCP) (Popov-Raljić & Blešić, 2012; 2016). The basis of the food safety system to be adopted in catering is a combination of preconditions / standard operating procedures for sanitation (SSOP) / good hygiene practice (GHP), then, good manufacturing practices (GMP) and food safety system, ie - hazard analysis and critical control points (HACCP) (Oliveira et al., 2016; Popov-Raljić & Blešić, 2021).

The obtained data indicate that in rural households of Serbia, according to employees, the application of HACCP system is at a relatively high level, given that the degree of application of procedures necessary for the functioning of HACCP system was rated

high, over 4. The claim is that business according to HACCP is not changed compared to the previous period and time during Covid-19, thus confirming the initial hypothesis H0. A slightly lower grade was found for the receipt of food from the supplier due to insufficient precision compliance with the maintenance of the required temperature during transport and delivery of the necessary documentation (Xsr = 3.92; Sd = 0.71; Cv = 18.04). Contrary to the above, the highest score was recorded for an important segment - intake of fresh fruits and vegetables and sensory quality (appearance-color; smell and taste; texture) (Xsr = 4.44; Sd = 0.78; Cv = 17.53) and regular monitoring, and recording the temperature in the premises intended for storage (Xsr = 4.39; Sd = 0.70; Cv = 15.97). Temperature control when receiving and storing food is extremely important, if frozen food is used in a rural household because there is a greater risk of bacteria and spoilage for food thawed at room temperature, so the best way to safely thaw, for example: meat, poultry and fish meat in the refrigerator; using a microwave oven or immersing in hygienically correct cold water (Lateefat, et al., 2018).

Similar values were obtained when answering the question regarding inventory and tools used for processing food of different origin (animal / vegetable) (Xsr = 4.04), while statistical data processing showed variation (Sd = 1.22; Cv = 30.31), which indicates possible occasional omissions in rural households when handling certain tools and inventory (for example, the use of the same knives, the same board). When it comes to the attitudes of respondents related to the business of rural households on the principles of good hygiene (GHP) and good manufacturing practice (GMP), as well as the application of HACCP, the average values of all answers are at a very high level (Xsr ≈ 4.50). The results of all aspects of HACCP application in rural tourist households during the pandemic (Table 1), except for verification of evidence of maintenance of required transport temperature and all necessary documentation at reception, indicate similar distributions of responses: the vast majority of respondents rated consistency 4 or 5. HACCP operations in rural tourist households contribute to better sustainable food safety and quality - generally observed during the Covid 19 pandemic, which was confirmed by the results of the survey (Xsr = 4.36; Sd = 0.73; Cv = 16.67).

Table 1. Descriptive indicators of the perception of the application of the HACCP system in rural households by employees in Serbia during the Covid-19 pandemic.

PERCEPTION OF APPLICATION OF HACCP DURING A PANDEMIC	X_{sr}	S_d	C_v
When receiving food from the supplier, you require proof of maintaining the required temperature in transport and all the necessary documentation	3,92	0,71	18,04
When receiving fresh fruits and vegetables, you sensory control and evaluate the quality	4,44	0,78	17,53
Foods that do not meet the requirements prescribed by the HACCP system upon receipt are returned to your supplier	4,28	0,71	16,71
Regularly monitor and record the temperature in the rooms intended for storage	4,39	0,70	15,97

PERCEPTION OF APPLICATION OF HACCP DURING A PANDEMIC	X_{sr}	S_d	C_v
Keep regular records of maintaining the hygiene of work surfaces and premises in which food is processed and stored according to established procedures	4,33	0,66	15,35
Use the same boards to process foods of different origins (animal, plant)	4,04	1,22	30,31
Use the same knives to process food of different origins (animal, vegetable)	4,00	1,12	28,04
Ice machines and ice containers are cleaned and maintained according to established procedures	4,28	0,74	17,29
Selectively dispose of waste from the kitchen block and bar and store in appropriate containers at a temperature of 0 to + 5 ° C	4,25	0,91	21,48
ATTITUDES OF EMPLOYEES IN RURAL HOUSEHOLDS			
It is necessary that the rural tourist household has a standard recipe / product description for each dish prepared in the kitchen block or a drink prepared in the bar	4,57	0,71	15,16
It is necessary that the rural tourist household cooperates with accredited laboratories that perform health testing of water, food and beverages	4,46	0,75	16,85
It is obligatory to keep records of preventive measures against rodents, insects and other pests in the rural tourist household	4,49	0,65	14,52
In a rural tourist household, it is necessary to establish a system of safe provision of food and beverage services in all phases of reception, storage, processing and trade.	4,51	0,66	14,58
Operating according to the HACCP system contributes to better quality operations of rural tourist households	4,36	0,73	16,67

Source: author`s research

*X_{sr} – Mean value, sd – Standard deviation, C_v - Coefficient of variation

The results of examining the differences between the mean values of the answers obtained from the respondents engaged in rural tourist households applying good hygiene practice (GHP) and good manufacturing practice (GMP) showed a value of p = 0.02 (less than p <0.05 characteristic of 95% probability), which indicates that the application of good hygiene and manufacturing practices significantly affects the level of responses. When it comes to attitudes related to business practice and HACCP, no statistically significant differences were found between the answers of respondents engaged in facilities that apply GHP and GMP and those whose practice deviates from this rule (thus confirming hypothesis H2). The specific conditions in which rural households operate (limited financial and human resources, lack of knowledge on food safety management, etc.) indicate that certain elements of the security system (eg record keeping) are more difficult to implement than in medium and large enterprises. , like the food industry (Dzwolak, 2017). When asked whether you keep regular records of maintaining the hygiene of work surfaces and premises in which the processing and storage of food in a rural household is performed, a statistically significant difference was found between the answers of respondents employed in rural households with HACCP certified and respondents employed in households they do not have certified HACCP. The obtained

value p = 0.17 (higher than p <0.05 characteristic for 95% probability), indicates that HACCP certification does not significantly affect the level of responses obtained. When it comes to attitudes related to business practice and HACCP, respondents from rural households in which HACCP is certified rated their attitudes statistically significantly higher that doing business under the HACCP system contributes to the overall business of a rural tourist household (confirming hypothesis H3). Obtained results of testing the differences between the mean values of responses obtained from respondents engaged in rural households in which the person responsible for HACCP was appointed and those where the appointment was not made, a value of p = 0.00 (less than the significance threshold p <0.05 characteristic of 95% probability), which indicates that the appointment of a responsible person (HACCP team leader) significantly affects the level of responses received. Table 2. shows p values as indicators of probability that there are no statistically significant differences between the distributions of responses of different groups of respondents. All values less than 0.05 indicate a 95% probability that differences between different groups of respondents exist, and for values less than 0.01 the probability that differences exist is over 99%.

Table 2. Probability of non-existence of differences in the distributions of respondents' responses depending on the perception of the application of the HACCP system in rural households in Serbia

PERCEPTION OF APPLICATION OF HACCP DURING A PANDEMIC	CS	GHP GMP	ARP	AT	CTR	TS
When receiving food from the supplier, you require proof of maintaining the required temperature in transport and all the necessary documentation	0,7819	0,7340	**0,0104**	**0,0065**	**0,0317**	**0,0071**
When receiving fresh fruits and vegetables, you sensory control and evaluate the quality	0,4606	0,1848	**0,0225**	**0,0002**	**0,0002**	**0,0150**
You return food that does not meet the requirements prescribed by the HACCP system to your supplier upon receipt	0,3410	**0,0078**	**0,0014**	**0,0000**	**0,0044**	**0,0021**
Regularly monitor and record the temperature in the rooms intended for storage	0,0981	**0,0044**	**0,0009**	**0,0000**	**0,0004**	**0,0001**
Keep regular records of maintaining the hygiene of work surfaces and premises in which food is processed and stored according to established procedures	0,0507	**0,0097**	**0,0010**	**0,0014**	**0,0008**	**0,0029**
Ice machines and ice containers are cleaned and maintained according to established procedures	0,0926	**0,0457**	**0,0000**	**0,0000**	**0,0001**	**0,0004**

PERCEPTION OF APPLICATION OF HACCP DURING A PANDEMIC	CS	GHP GMP	ARP	AT	CTR	TS
Selectively dispose of waste from the kitchen block and bar and store in appropriate containers at a temperature of 0 to + 5 ° C	0,7830	0,3662	**0,0001**	**0,0000**	**0,0003**	**0,0032**
ATTITUDES OF EMPLOYEES IN RURAL HOUSEHOLDS						
It is necessary that the rural tourist household has a standard recipe / product description for each dish prepared in the kitchen block or a drink prepared in the bar	0,4244	0,2755	0,3108	0,0113	0,3078	0,0666
It is necessary that the rural tourist household cooperates with accredited laboratories that perform health testing of water, food and beverages	0,3046	0,2116	0,6730	0,3019	0,5804	0,7233
It is obligatory to keep records of preventive measures against rodents, insects and other pests in the rural tourist household.	0,3613	0,1724	0,8071	0,0676	0,6306	0,0411
In a rural tourist household, it is necessary to establish a system of safe provision of food and beverage services in all phases of reception, storage, processing and trade.	0,2343	0,0496	0,7972	0,1618	0,3931	0,0762
Operating according to the HACCP system contributes to better quality operations of rural tourist households	0,0484	0,1671	0,4393	0,0489	0,1091	**0,0039**

Source: author`s research

*CS- Certified HACCP system; GHP and GMP - Application of GHP and GMP; ARP-Appointed responsible person; AT - Appointed HACCP team, CTR - Clear HACCP team responsibilities; TS - Trained staff.

Suppliers who deliver food of animal origin in addition to mandatory analyzes of microbiological safety (including toxicology), physico-chemical and sensory analysis must have a certified HACCP system, while rural households are not required to certify but must operate according to the principles of HACCP system (Popov-Raljić & Blešić,2021). That the certified HACCP system does not significantly affect the level of the obtained responses was priced with the obtained value p = 0.17 (which is significantly less than the value of p <0.05 characteristic for 95% probability), which indicates the confirmation of hypothesis H1. The results indicate that there is no statistically significant difference in the application of the food safety system in rural tourist households that have a certified HACCP system and those that do not have a certificate, and the alternative hypothesis H1a was refuted.

Previous research has also shown why there is a decline in tourist traffic in rural areas. Scott et al., (2020) in their research entitled How Does Household Spending Respond to an Epidemic? Consumption During the 2020 COVID-19 Pandemic, they indicated that as the number of cases grew, households began to radically change their typical consumption in a number of major categories. Principato et al., (2020), point out that a large amount of food waste is generated, due to improper management of food control and safety. In their study, Caring more about food: The unexpected positive effect of COVID -19 lockdown on household food management and waste, on a sample of 1.078 Italians, also pointed to some positive effects of the pandemic, as the largest percentage of respondents reduced the amount of throws food, and began to use food in households properly and in a controlled manner. A similar study was conducted by Han et al., (2021), who talk about the Covid-19 crisis and food safety. They point out that the pandemic has imposed huge consequences, including economic losses and threats to human health. They investigate the impact on the food supply system and food safety. The article highlights the effectiveness of food safety management after a pandemic. They also say that there is a possibility of foodborne infection, especially if the environment is unhygienic and does not operate according to appropriate safety standards.

Conclusions

The impact of COVID-19 around the world is primarily a human tragedy, which affects the health of hundreds of thousands of people, but has an increasing impact on both the global economy and the economy (Farzanegan et al., 2020). The aim of the research was to collect the opinion of employees in rural households, most of whom are also hosts of rural households that provide catering services. The aim was certainly not to highlight the results of the implementation of the HACCP system, before and after the pandemic, but to examine the attitude of employees on this issue. The goal of applying the HACCP principle in food retail and serving is for the operator to take appropriate measures to ensure safe and quality food (Garayoa et al., 2014). Food safety management should be fully integrated into the work as well as the actions taken during the business. With the spread of the COVID-19 pandemic, challenges related to food safety are in the focus of business of all food producers, catering facilities, but also rural tourist households (Shi et al., 2021). Due to the specific conditions in which small businesses operate as rural tourist households, elements of the food safety system are more difficult to implement than in medium and large companies (Dzwolak, 2014). During the COVID-19 pandemic, both in catering facilities and in rural tourist households, there were significant changes in behavior and an increase in the demand of food and beverage consumers for safe food and beverage service (Principato et al., 2021). The authors of the paper conducted field research in 47 rural households of the Republic of Serbia, on a total sample of 286 employees. A modified questionnaire Ahuja & Sicherer (2007) was used; Sharma (2011) and Soon (2018). The obtained results were processed in the statistical software Statistica 14.0 (Dell Inc.,2020). After the analysis of the obtained data, the following can be concluded, which gives the answer to the set hypotheses:

- There are no statistically significant differences in the answers of employees engaged in rural households in which the HACCP system is certified, and those in which this is not the case.

- Perception of respondents that the rural household in which they are engaged operates on the principles of good hygiene (GHP) and good manufacturing practice (GMP), affects that respondents at different levels perceive the application of different aspects of the HACCP system, than respondents in rural households where GHP and GMP do not apply, which is a logical conclusion, given the connection of the listed aspects of HACCP application with GHP and GMP.

- Perception of respondents that GMP and GHP are applied in the rural household does not affect the differences in respondents' attitudes towards HACCP.

- All aspects of HACCP implementation related to human resources, including appointment of a responsible person, appointment of HACCP team and clear differentiation of team members 'responsibilities, as well as training of HACCP staff, result in differentiation of HACCP implementation perception, but not differentiation of respondents' attitudes towards HACCP.

The paper can have a wide scientific, economic and social significance. Based on the obtained results, it is possible to determine the attitude of employees in rural households on the actual level of application of the HACCP safety system in rural catering facilities, and to contribute to similar research. The importance of the work contributes to the development of awareness among the employees about the adherence to the safety measures of the HACCP system, especially during the pandemic. Then the measures must be respected, and even expanded, as some authors claim. There were limitations in the persistence of epidemiological measures during the pandemic. Many facilities were closed during this period, so the sample is relatively small. However, the advantage of the survey is that the respondents were employees, who must be instructed in all food safety measures and in the workplace. The work related to the position on the application of the HACCP safety system is important due to the profile of the respondents, because tourists are certainly not informed about all existing measures, but they can notice if some key measures are not respected.

Conflict of interests

The authors declare no conflict of interest.

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THE RISE OF CORPORATE ENVIRONMENTAL RESPONSIBILITY IN SERBIAN ECONOMY: THE CASE OF AGRI-FOOD INDUSTRY

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A B S T R A C T

The purpose of this paper is to investigate corporate environmental responsibility in the agri-food industry in the Republic of Serbia. Empirical research was conducted on a sample of 112 managers of agri-food organizations operating in the territory of the Republic of Serbia, randomly selected from publicly available databases, using Computer Assisted Web Interview - CAWI technique. Data analysis in this study consisted of descriptive statistics. Univariate analysis was used through individual ranking statistics. Nonparametric Kruskal-Wallis and post hoc Mann Whitney U test were used to test the significance of differences. Research results show above average level of corporate environmental responsibility in agri-food business world in the Republic of Serbia, yet, not sufficiently high comparing to Serbian consumers view, leaving room for improvement. Food processing organizations proved to be the most sensitive to corporate environmental responsibility issue followed by food manufacturing organizations, and agri-food supply and distribution chain organizations the least.

Introduction

Nowadays, environmental awareness appears as a universal European value, influencing and directing European business practices, strategies, and policies (Mihajlović, Voza, Milošević, Durkalić, 2016). Sustainable development policy is increasingly finding a place in economies of developed countries (Popović, 2009), leading to the rise of significance of corporate environmental responsibility (CER) as a tool for achieving environment preservance worldwide. Since the Republic of Serbia as a strategic objective has defined membership in the EU, a process of harmonization with current EU policies is inevitable. Agri-food sector is definitely an essential part of that process, since with the prospect of the accession of Serbia to the EU, the elaboration and implementation of agri-environmental measures and explicit requirements for farmers

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to use agri-environmental measures become highly important (Birovljev, Matkovski, Ćetković, 2014). However, economic sanctions, declining production and increasing poverty have significantly reduced the state's capacity to invest in consumer protection, as well as farmers' awareness of the need to protect the environment (Jovanić, 2013). Results of recent research study clearly show that Serbia is lagging behind the EU in the implementation of agri-environmental measures, and in the coming period Serbia will have to make additional efforts to create measures and mechanisms for more effective implementation of agri-environmental programs (Zekić, Maktovski, Kleut, 2018). Alignment of behavior with mandatory standards and rules from the corpus of agri-environmental measures and principles of good agricultural practice is an important step towards preserving the environment and protecting the health of humans, plants and animals. On the other hand, it is an important precondition for the export of agricultural products from Serbia (Jovanić, 2013).

The purpose of this paper is to provide a systematic analysis of CER issue in agri-food industry and to explore importance of this issue in Serbian economy. The paper is organized as follows: after the introduction part, an overview of the scientific and professional literature is given, followed by a description of the research with an analysis of results. Concluding remarks are provided at the end of the paper.

Literature review

Today many companies have accepted their responsibility to do no harm to the environment (Hart, 1997). Changes in citizens' values, lifestyles, and preferences, as well as a new business culture that considers environmental impacts of productive activity (Luhmann, Theuvsen, 2016; Hartmann, 2011), have increased interest in the agricultural economics field towards the concept of corporate environmental responsibility (Nazzaro, Stanco, Marotta, 2020).

Corporate environmental responsibility can be defined as the duty to cover environmental implications of company's operations, products and facilities; eliminate waste and emissions; maximize the efficiency and productivity of its resources; and minimize practices that might adversely affect the enjoyment of country's resources by future generations (Mazurkiewicz, 2004). Corporate environmental responsibility refers to an enterprise's active reduction of environmentally adverse behaviors and participation in environmentally beneficial activities in its daily business activities (Zeng, Qin, Zeng, 2019; Li, Cao, Zhang, Chen, Ren, Zhao, 2017). Banerjee, Iyer and Kashyap (2003) define corporate environmentalism as the recognition of the importance of environmental issues facing the firm and the integration of those issues into the firm's strategic plans. According to these researchers, corporate environmentalism contains two dimensions: (1) the environmental orientation, defined as the disposition of managers to consider environmental issues, and (2) the environmental strategy, which shows how environmental issues are addressed by the company and how they fit in the company's long-term strategy.

CER is significant for the food sector as this sector has a strong impact on the economy, the environment and the society in general (Hartmann, 2011). This sector is especially prone to problems in sustainability given its high impact and dependence on natural, human and physical resources (Topp-Becker, 2017; Vilkė, Pareigienė, Stalgienė, 2015; Genier, Stamp, Pfitzer, 2009). Sustainability challenges faced by the food sector are numerous, including environmental sustainability – reflected in the usage of natural resources, animal welfare, etc.; social sustainability – reflected in labor and work conditions, food safety, food quality etc.; and economic sustainability – reflected in energy usage, waste management, renewable energy resources etc. (Liapakis, Costopoulou, Tsiligiridis, Sideridis, 2017; Bilska, Wrzosek, Kołożyn-Krajewska, Krajewski, 2015; Stancu, 2012). In addition, agriculture is one of the biggest pollutants of the environment, next to industry, mining and traffic, which significantly affects the increasing importance of the growth of corporate environmental responsibility in this sector. Likewise, companies in the agri-food sector must also ensure CER practices application in everyday business activities, as well as observance of the food safety principles and consumer protection (Zaman, Panait, Voica, Ene, 2020). Not only that, according to some researchers, it is necessary that effective CER must affect the entire agri-food supply chain, and not to be limited to company boundaries (Manning, 2013; Amaeshi, Osuji, Nnodim, 2008), which carries the risk that a company that acts undesirably can damage the reputation of some or all of its associated companies (Wiese, Toporowski, 2013).

So far research clearly demonstrates that CER can be conceived as a tool through which agri-food companies can increase their competitiveness through not only achieving products' differentiation in the market, but also through companies' more efficient use of resources (Manning, 2013; Kong, 2012; Marotta, Nazzaro, 2012; Forsman-Hugg, Katajajuuri, Pesonen, Paananen, Makela, Timonen, 2008). CER generates value-added benefits by affecting consumers' perceptions towards companies and products, while increasing consumers' loyalty and satisfaction (Lerro, Raimondo, Stanco, Nazzaro, Marotta, 2019; Lerro, Caraciolo, Vecchio, Cembalo, 2018; Hartmann, Heinen, Melis, Simons, 2013), which leads to a higher willingness to pay for environmentally responsible companies' products (Lerro, Vecchio, Nazzaro, Pomarici, 2019). CER also increases a company's attractiveness as an employer, while enhancing employee satisfaction (Barakat, Isabella, Boaventura, Mazzon, 2016; Turban, 1997). CER positively influences innovation strategies, as it compels companies to constantly increase their products' quality and implement sustainable processes towards innovation. Therefore, CER strengthens companies' reputations, with benefits to their image and identity, and in consumers' recognition of the brand and the company's products (Nazzaro, Lerro, Stanco, Marotta, 2019; Briones Peñalver, Bernal Conesa, de Nieves Nieto, 2018; Marotta, Nazzaro, 2012).

While some of Serbian researchers are aware of the necessity of environmental protection due to the Serbian goal to enter the EU, and have proposed and investigated various, but still limited possible environmental protection measures, methods and techniques in food

production and processing, Serbian agri-food sector has not drawn researcher's attention on CER. In so far agri-food research in Serbia, from the environmental perspective, special attention is given only to biomass combustion environmental negative effects minimization, with recommendation of placing it under legal framework (Mladenović, Nemoda, Paprika, Marinković, Repić, 2016). Stojanović, Lopičić, Milojković, Lačnjevac, Mihajlović, Petrović and Kostić (2012) recommend introduction of the new method for removing pollutants from the environment in the form of biosorption that is to replace conventional technologies. Nikolić, Savić and Nikolić (2005) advocate that the integrated approach to plant protection prevents possible contamination of land and ensures the protection of the environment. Special place is given to the organic agriculture (Marković, 2018; Zimonja-Kaljević, Petrović, Vukadinović, 2012; Katić, Cvijanović, Cicea, 2008; Bošković, Simić, Hojka, Vukosav, Sarić, 2006; Kovačević, 2004), to the regionalization of agricultural production in Serbia (Babović, Veselinović, 2010), to the application of grain and oilseeds storage technology in an atmosphere of inert gases (Brkić, Šarić, Gnip, 2001), to the optimization of nitrogen fertilizer quantities (Milivojac, 2013), to grooming eco-vegetables (Lazić, 1991), to optimizing meat processing and production (Baras, Turubatović, Tadić, Matekalo-Sverak, 2004), to agri-protection windbreaks in the process of land consolidation, (Trifković, Lazić, Marinković, Nestorović, 2017), to annual forage plants (Ćupina, Erić, Mihailović, Mikić, Krstić, Vučković, 2007), to high-performance harvesters (Barać, Đokić, Biberdžić, 2005), to combat of eco-crime (Subošić, Cvetković, Vuković, 2012) as potential media for enhancing environment preservance in the processes of food production. However, there is no article that deals with CER itself, as well as measures the importance of CER in Serbian agri-food industry.

The objective of this paper is to start filling this gap by providing insight into the importance of CER in agri-food industry in Serbian economy from the point of view of Serbian agri-food managers, as a whole, and by agri-food business subsectors, such as food manufacturing, food processing, and food supply and distribution chain.

Materials and methods

In order to investigate corporate environmental responsibility within agri-food industry in the Republic of Serbia, an empirical study was conducted. The research was based on the application of data collection methods from primary sources. The research was organized respecting principles of the methodology of scientific research by Mihailović (2012), which consists of research problem identification, research design, and results analysis.

Research purpose and research questions

The purpose of the research is to examine perceptions and attitudes of managers of agri-food business organizations operating in the Republic of Serbia in relation to the corporate environmental responsibility and to use surveyed perceptions and attitudes of managers to evaluate the degree of significance and impact of the corporate environmental responsibility in agri-food business life of the Republic of Serbia.

Considering that agriculture and food industry include several business subsectors, in the following part, the purpose of managerial opinion research is aimed at examining the conditionality of the degree of influence and importance of corporate environmental responsibility with these factors. In this way, it is possible to find out for which agri-food business subsector corporate environmental responsibility is of the greatest importance.

In order to fulfill the purpose of the research, following research subjects are defined: (1) measuring attitudes of managers of agri-food business organizations operating in the Republic of Serbia about corporate environmental responsibility and the influence of the corporate environmental responsibility on business decision making; (2) identifying and measuring the impact of agricultural and food industry business subsector on attitudes and perceptions of respondents in relation to the corporate environmental responsibility.

The research had following defined goals: (1) determining the degree of significance of corporate environmental responsibility for managers of agricultural and food industry business organizations operating in the Republic of Serbia; (2) determining the existence of statistically significant differences between agricultural and food industry business subsector and the degree of significance of corporate environmental responsibility for managers of agri-food business organizations operating in the Republic of Serbia.

The research is expected to lead to answers to following research questions: (1) to what extent corporate environmental responsibility has an impact on agricultural and food industry business decision making and agricultural and food industry business life in the Republic of Serbia; (2) whether there is and what, if any, statistically significant difference, the connection, between the agricultural and food industry business subsector and respondents' attitudes regarding the corporate environmental responsibility of agricultural and food industry business organizations operating in the Republic of Serbia.

Research participants

Participants in the study were managers of agricultural and food industry business organizations operating in the territory of the Republic of Serbia. The survey was conducted on a convenient random sample of 112 respondents, out of which 32.14% are employed in the food manufacturing subsector, 46.43% in the food processing subsector, and 21.43% in the agri-food supply and distribution chain subsector. Total of 14.29% of participants occupies top management positions, 46.43% occupies middle management positions, and 39.28% occupies operational management positions. Majority of respondents possesses faculty degree (BSc), 67.87%, 10.71% possess high school education degree, and in the equal number masters degree. Totally 67.86% of respondents are of a younger age, less than 45 years old. Regarding respondents' managerial experience 46.43% works overall for more than 10 years in current position. Males and females were equally present. Sampled agri-food business organizations belong primarily to middle size organizations in terms of number of permanent employees, 53.57%, and small organizations, 35.71%, totally 10.71% of agri-food

business organizations belong to large organizations. Testing managers of business organizations has been conducted using quantitative research techniques via the Internet (Computer Assisted Web Interview - CAWI) with previous consent from each subject for participation in the study. As a sample frame, publicly available databases of agricultural and food industry business organizations in Serbia are used.

Research instrument

As a research tool for implementation of the method of collecting data from primary sources, the 7-point Likert scale questionnaire was used, established on the basis of review of the scientific and expert literature and as recommended by Mihailović (2012), Saunders, Lewis and Thornhill (2009), Babbie and Mouton (2007), Welman, Kruger and Mitchell (2005), Boyce (2003), and Dillman (2000), and in compliance with special needs of research. After demographic characteristics of respondents, and data about the organization, the questionnaire contained questions pertaining to corporate environmental responsibility. Results of Cronbach's alpha test of questionnaire as a measure of its reliability indicate the consistent reliability of results obtained ($\alpha > 0.7$) (Cohen, Manion, Morrison, 2007).

Research model

The research model is based on examining perceptions and attitudes of managers of agri-food business organizations operating in the Republic of Serbia in relation to the corporate environmental responsibility, and its impact on their business decision choice. In the second step, the research model refers to the examination of the conditionality of the degree of influence and the importance of the corporate environmental responsibility with specific respondents' agricultural and food industry business subsector.

Data analysis

Items of the final questionnaire were analyzed using the statistical package SPSS v20. Univariate analysis containing individual ranking statistics was used. The non parametric Kruskal-Wallis test and post hoc Mann Whitney U test were used to test the significance of differences. Results with $p < 0.05$ were declared significant.

Results and discussion

Evaluation of the importance of corporate environmental responsibility for agri-food managers in the Republic of Serbia

In order to evaluate the importance of corporate environmental responsibility for agricultural and food industry managers in the Republic of Serbia, univariate analysis containing individual ranking statistics was used. Research findings (Table 1.) reveal that most managers of agri-food business organizations operating in the Republic of Serbia recognize the crucial role that the corporate environmental responsibility plays for the success and sustainability of their operations, both in the domain of environmental

orientation and in the domain of environmental strategy, since they all carry means that are above average ($\mu>4.00$). The domain of environmental orientation, measured via the degree of embeddedness of environmental awareness in everyday business decision making, received the highest rankings, but previous recent research shows that there is an evident difference between Serbian agri-food managers and Serbian consumers, in favour of Serbian consumers (5.13 vs. 6.32) (Milić, 2020), leaving room for improvement.

Table 1. Statistical summary of univariate analysis of the importance of corporate environmental responsibility for agricultural and food industry managers in the Republic of Serbia

Corporate environmental responsibility measure	Mean (μ)	Std. dev.
1. To what extent is the environmental awareness embedded in your business decision making	5.13	1.7395
2. Our organization focuses on protecting the natural environment as a stakeholder	5.08	1.7303
3. To what extent is the organization you work for involved in environmental activities	5.00	1.6777
4. To what extent are the activities of the organization in which you work related to environmental protection proactive	4.50	1.8657
5. To what extent is there a record of violations of environmental principles in your organization	2.64	1.6942

Source: author's research

Further, regarding the environmental strategy domain, measured via various gradual degrees of corporate environmental involvement, only slight corporate environmental orientation-strategy gap is detected, with received a bit lower rankings, demonstrating presence of some barriers that are more dominate than motivators for corporate environmental strategy development and deployment, but not at much higher level. Serbian agri-food organizations focus on protecting the natural environment as a stakeholder, and are actively involved in environmental activities, almost equally to the degree of their environmental awareness. However, though above average, study findings reveal that the activities of Serbian agri-food organizations related to environmental protection are not as much proactive with received significantly lower rankings. On the positive side, the lowest significance was assigned to the extent to which there is a record of violations of environmental principles in Serbian agri-food organizations, which received rankings significantly below average, but still demonstrating the existence of some agri-food organizations that do not follow environmental principles in doing business.

Research implication is that, even though received rankings are above average ($\mu>4,00$), when compared to Serbian consumers view of this issue, corporate environmental orientation is not sufficiently present in managers' minds and business life within the agri-food industry in the Republic of Serbia, and hence, consequently, corporate environmental strategy development and deployment itself, altogether with present

slight corporate environmental orientation-strategy gap, cannot reach higher levels, missing opportunity to gain significant competitive advantage on Serbian market based on environmentally conscious business activities, hence demonstrating higher levels of corporate environmental responsibility in agri-food business world in the Republic of Serbia, so highly appreciated by Serbian consumers, and accordingly achieve better business performance results.

Evaluation of the influence of agri-food industry business subsector on corporate environmental responsibility importance for managers in the Republic of Serbia

In order to determine corporate environmental responsibility per agri-food industry business subsectors in the Republic of Serbia, the investigation of the influence of certain agri-food industry business subsectors, such as food manufacturing, food processing, and agri-food supply and distribution chain, on the perception of corporate environmental responsibility measured via its two basic dimensions: environmental orientation and environmental strategy is performed. The nonparametric Kruskal-Wallis and post hoc Mann Whitney U test were used to examine the significance of differences. Results with $p<0.05$ were declared significant (Table 2.).

Table 2. Agri-food industry business subsector impact on corporate environmental responsibility importance

CER measure	Agricultural and food industry business subsector rank			p
	Food manufacturing organization (x_1)	Food processing organization (x_2)	Agri-food supply and distribution chain organization (x_3)	
To what extent is the environmental awareness embedded in your business decision making	2857.5	2877.5	1525	P<0.05
Our organization focuses on protecting the natural environment as a stakeholder	2557.5	3792.5	2165	P>0.05
To what extent is the organization you work for involved in environmental activities	3185	3667.5	2327.5	P>0.05
To what extent are the activities of the organization in which you work related to environmental protection proactive	3070	3255	2190	P<0.01
To what extent is there a record of violations of environmental principles in your organization	1642.5	4180	2052.5	P<0.01

Source: author's research

In relation to the importance of corporate environmental responsibility for managers of agri-food business organizations operating in the Republic of Serbia, it was examined whether there are statistically significant differences between respondents coming from three agri-food industry business subsectors: food manufacturing, food processing, and agri-food supply and distribution chain. Results reveal that respondents from food processing business organizations comparing to respondents from food manufacturing, and agri-food supply and distribution chain business organizations, give more importance to embedding environmental awareness in business decision making (2857.5 vs. 2877.5 vs. 1525; $p<0.05$, Kruskal-Wallis test). Also, according to research results, respondents from food processing business organizations give more importance to proactive environmental behaviour comparing to respondents from food manufacturing, and agri-food supply and distribution chain business organizations (3070 vs. 3255 vs. 2190; $p<0.01$, Kruskal-Wallis test). As far as the record of violations of environmental principles is concerned, research results show that the highest rate of environmental violations is present in food processing organizations, followed by agri-food supply and distribution chain organizations, ending with food manufacturing organizations with the least (1642.5 vs. 4180 vs. 2052.5; $p<0.01$, Kruskal-Wallis test). Also, from the same data can be seen that food manufacturing sector attaches more importance to the same previously mentioned first two measures of corporate environmental responsibility comparing to agri-food supply and distribution chain sector. For all other investigated corporate environmental responsibility measures, no statistically significant differences were found ($p>0.05$).

For statistically significant measures, multiple comparisons were performed using the Kruskal-Wallis test of any pair of agri-food business subsectors. In this case, the test was identical to the Mann Whitney U test with normal approximation (Table 3.).

Table 3. Multiple comparisons of agri-food industry business subsectors per statistically significant CER measures

CER measure 5. To what extent is there a record of violations of environmental principles in your organization				
Pair	Difference	H statistic	Critical value	p-value
x_1-x_2	0	10.6102	5.7308	0.001125
x_1-x_3	0.5	5.0267	5.7308	0.02496
x_2-x_3	0.5	0	5.7308	1
CER measure 4. To what extent are the activities of the organization in which you work related to environmental protection proactive				
Pair	Difference	H statistic	Critical value	p-value
x_1-x_2	2.5	8.2436	5.7308	0.00409
x_1-x_3	0.5	0.3753	5.7308	0.5401
x_2-x_3	2	5.716	5.7308	0.01681
CER measure 1. To what extent is the environmental awareness embedded in your business decision making				
Pair	Difference	H statistic	Critical value	p-value
x_1-x_2	1.5	8.3406	5.7308	0.003877
x_1-x_3	0.5	0.7927	5.7308	0.3733
x_2-x_3	1	0.6296	5.7308	0.4275

Source: author's research

In relation to CER measure 5. "To what extent is there a record of violations of environmental principles in your organization", statistically significant differences were found in two pairs of agri-food industry sectors: (1) food manufacturing and food processing ($p<0.01$), and (2) food manufacturing and agri-food supply and distribution chain sector ($p<0.05$). In pair, food processing and agri-food supply and distribution chain sector, no statistically significant difference was found ($p>0.05$).

In relation to CER measure 4. "To what extent are the activities of the organization in which you work related to environmental protection proactive", statistically significant differences were found in two pairs of agri-food industry sectors: (1) food manufacturing and food processing sector ($p<0.01$), and (2) food processing and agri-food supply and distribution chain sector ($p<0.05$). In pair, food manufacturing and agri-food supply and distribution chain sector, no statistically significant difference was found ($p>0.05$).

In relation to CER measure 1. "To what extent is the environmental awareness embedded in your business decision making", statistically significant difference was found in one pair of agri-food industry sectors: food manufacturing and food processing sector ($p<0.01$). In other two pairs of agri-food industry sectors: (1) food manufacturing and agri-food supply and distribution chain sector, and (2) food processing and agri-food supply and distribution chain sector, no statistically significant difference was found ($p>0.05$).

Conclusions

This empirical research paper gives an overview of corporate environmental responsibility within the agri-food industry in the Republic of Serbia. The corporate environmental responsibility issue was considered, except from the general point of view of agri-food managers, also from the point of view of the influence of specific agri-food industry business subsector, on the other side. Obtained results show that corporate environmental responsibility in agri-food business world of Serbia has not reached the level of importance it has for Serbian consumers, raising research implication for Serbian agri-food managers, for developing and implementing environmentally based business activities as insufficiently exploited source of sustainable competitive advantage on domestic market. Also, slight corporate environmental orientation-strategy gap is detected, in favour of environmental orientation, demonstrating presence of some barriers that are more dominate than motivators for corporate environmental strategy development and deployment, indicating the necessity for revealing key CER barriers and actors. Serbian agri-food organizations focus on protecting the natural environment as a stakeholder, and are actively involved in environmental activities, almost equally to the degree of their environmental awareness, yet not in the sufficiently proactive manner. On the positive side, there is low rate of violations of environmental principles in Serbian agri-food organizations detected, but still demonstrating the existence of some agri-food organizations that do not follow environmental principles in doing business. Corporate environmental responsibility is, so far, especially appreciated by food processing organizations, followed by food manufacturing organizations, and by agri-food supply and distribution chain organizations the least, especially in the

domain of environmental orientation and proactive environmental behaviour, followed with the highest rate of environmental violations being present in food processing organizations, then in agri-food supply and distribution chain organizations, ending with food manufacturing organizations with the least. The food manufacturing sector is more environmentally oriented and proactive comparing to agri-food supply and distribution chain sector. Research indication is that, currently, agri-food business organizations which are more directly linked to potential environmental hazards are more devoted to CER issues, but still in insufficient manner.

The scientific contribution of the conducted empirical research is reflected in identifying the importance of corporate environmental responsibility for agri-food managers living and working in the Republic of Serbia, both in general, and by specific agri-food industry business subsector. The social contribution of the research refers to the possibilities of applying obtained results in practice. The analysis of research results should serve as a guideline and assistance to the management of agri-food businesses operating in the Republic of Serbia in creating successful business strategies, which should result in better positions on the Serbian market.

Conflict of interests

The authors declare no conflict of interest.

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DISTRIBUTION OF AGRICULTURAL LANDS AND LAND OWNERSHIP IN RUSSIA

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A R T I C L E I N F O	A B S T R A C T
	Among the countries of the world, Russia is one of the richest in agricultural land. However, a quantitative advantage is poorly transformed into a qualitative one. As a result, there has been a gradual decrease in productive land, a decline in crop yields, the use of highly productive lands as less valuable land categories, and land degradation. These negative processes cause severe damage to both the agricultural sector and the country's economy as a whole. One of the reasons for such drawbacks is the underdevelopment of land use processes and forms of land ownership, which discourage land productivity growth and rational use of agricultural lands. In this paper, the authors analyze the most critical challenges in the sphere of agricultural land distribution in Russia and suggest ways to improve the efficiency of land ownership and land use patterns.

Introduction

The contemporary agricultural sector in Russia operates in the conditions of aggravated external challenges due to the economic sanctions imposed by the USA and the EU, counter-sanctions on food imports set by Russia, and the need for import substitution of various categories of food and agricultural products (Erokhin & Gao, 2020; Prabhakar et al., 2020). The solution to these problems is hardly possible without developing an efficient system of rational use of agricultural lands.

Russia's total area amounts to over 1.7 billion ha, excluding the internal and territorial sea (Federal Service for State Registration, Cadastre, and Cartography [Rosreestr], 2021). The land fund comprises wooded lands (65.8% of the total land fund), agricultural lands (22.4%), undistributed lands (5.2%), lands of specially protected areas (2.8%), residential areas (1.2%), and industrial lands and other special-purpose lands (1.0%).

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Farmland comprises 51.5% (197.7 million ha) of the total agricultural land fund, while other types of agricultural land amount to 48.5% (186.0 million ha). Farmland is also a part of residential areas (47.8%), lands under industrial and power facilities, transport, and communication infrastructure (6.9%), lands of specially protected areas (1.5%), wooded lands (0.4%), and undistributed lands (9.2%). The total farmland acreage amounts to 222.1 million ha or 13% of total Russia's land fund.

Despite these impressive figures, many scholars report poor conditions of many agricultural lands (Dugina, 2015; Gadzhiev, 2015; Kuzmich & Gorr, 2016; Erokhin et al., 2020a; Panait et al. 2020; Constantin et al., 2021; Sikandar et al., 2021). Russia has failed to become a global food production leader with 10% of the world's agricultural land and 55% of black earth soils. Its modest share of the global gross agricultural production is about 1%. The land transformations that have been evolving since the 1990s have not established explicitly favorable conditions for the rational use and protection of land (Dugina, 2015). The area of unused agricultural land is growing. It has reached 25% of their total area. Over the past fifteen years, the intended use has been changed for more than two million plots out of thirteen. Land degradation, water and wind erosion, desertification and waterlogging, thickening, and impoverishment of soils annually remove about two million ha of agricultural land from circulation. The agricultural output loss due to a decrease in land resource potential amounts to ten million tons of grain equivalent. Many agricultural organizations do not have rights to land. Therefore, land uses have not been legally individualized in particular territories as a unified land and property complex – an object of land and property legislation.

Most researchers agree that in the current conditions, new approaches to establishing national agricultural policy are required in Russia (Prishchepov et al., 2013; Gadzhiev, 2015; Erokhin et al., 2020b; Gao et al., 2019; Vorobyov et al., 2019; Khlystun, 2018; Kotelevskaya, 2018). However, the visions of such approaches vary. Thus, Trafimov and Nikonov (2018) and Kostyaev et al. (2015) emphasize the necessity to increase the concentration of agricultural lands in agricultural holdings that could improve access to land of small producers and provide incentives for revitalization and sustainable development of rural territories in Russia. Melnikov (2019) develops the concept of a multi-contour land plot as an object of land relations in respect to small and isolated areas and interspersed plots that cannot be effectively used separately from each other due to economic reasons. Zavorotin et al. (2019b) establish a methodological approach to studying the mechanism of land relations transformation in agriculture based on changing the institutional environment, analysis of institutions, costs, and factors, and identification and assessment of institutional traps. Zharov (2019) advocates for the comprehensive analysis of the land policy purpose along with the vector of contemporary development of the agricultural sector and the nature of land relations.

In view of diverse approaches to developing land policy measures, new methods are needed to ensure effective land use, high-quality accounting and evaluation, protection of land from degradation, and control over its intended use. Therefore, it is worthwhile drawing historical parallels between the current state of land policy and the experience

of land relations reform, comparing methods of their regulation, assessing the risks of their application in current conditions, and selecting land policy tools that meet the contemporary needs of the agricultural sector and the entire economy. The authors hypothesize that a gradual decrease in the area of productive land and a decline in crop yields in Russia have emerged due to the underdevelopment of land use processes and forms of land ownership. In this light, the paper aims to analyze the most critical challenges in the sphere of agricultural land distribution in Russia and suggest ways to improve the efficiency of land ownership and land use patterns.

Materials and methods

This study involves the retrospective analysis of the land statistics database from the Federal Service for State Registration, Cadastre, and Cartography (Rosreestr). We analyzed land ownership and land distribution patterns in 2005-2020 to determine how the land market has evolved since the fundamental land reforms implemented in Russia in the 1990s – early 2000s. At stage 1, land ownership relations patterns were studied in terms of the transformation of ownership relations, privatization (diversification of land property forms into private, shared, and joint ownership), and demarcation of land ownership (federal, territorial, and municipal levels). At stage 2, we defined critical problems of contemporary land relations in Russia by studying the structure of agricultural land ownership (divided into the property of individuals, legal entities, and public property), agricultural land distribution by a form of management (agricultural organizations, peasant farm enterprises, individual entrepreneurs, private subsidiary farms and other households, and non-profit organizations), and the composition of agricultural land use by a form of ownership (agricultural organizations and peasant farm enterprises). Finally, at stage 3, we suggested measures to improve land distribution patterns and the efficacy of land relations in Russia.

Results

Russia's land reform in the early 1990s did not result in a fundamental change of land legislation. One of the examples is denationalization that established the foundations of private ownership of agricultural lands and allowed for the diversification of agricultural production. Carried out through privatization, denationalization translated into the following issues:

- In the early stage of the land reform, private ownership of agricultural land was not declared. Land plots were leased to farmers and rural dwellers for permanent use and lifetime heritable tenure.

- Preservation of state ownership of land plots for northern reindeer herding, crafts, Cossack societies, etc., building relations on land use of such land plots based on lease or various titles for use.

- Preservation of state ownership of land plots used by certain types of agricultural enterprises (breeding, seed-growing, research, training, etc.);

- Lands were divided into four categories: land plots intended for free transfer to farm employees; land in state ownership transferred to municipal entities and rural settlements; mixed types of land that were allocated to regional entities for redistribution; non-agricultural land transferred to the successors of collective or state farms based on perpetual use right.

The establishment of private land ownership institutions involved paid and free approaches. The latter was implemented through the privatization of land shares according to the established regional rate. The free transfer was regulated at the regional level when the land was privatized by collective and state farms or transferred to private ones. To support the flexibility of the land reform, two mechanisms were introduced. First is the division of shared property and allocation of smaller plots. Thus, co-owners could allocate a land plot for starting a farm or making a transaction (lease, sale, contribution to the authorized capital, etc.). Second is the consolidation of land shares and allocation of land plots to prevent excessive fragmentation of agricultural lands.

The privatization allowed to establish land market and improve the flexibility of land ownership and land use. During state ownership transformation, part of agricultural land was privatized, which gave a grounding in private ownership and joint ownership. The latter was structured into shared and collective ownership. The remaining part of state ownership is undergoing a demarcation procedure (Figure 1). Land turnover made it possible for owners and people involved in agricultural production to conclude transactions and concentrate land shares.

Figure 1. Land ownership relations patterns in Russia as a result of the land reform
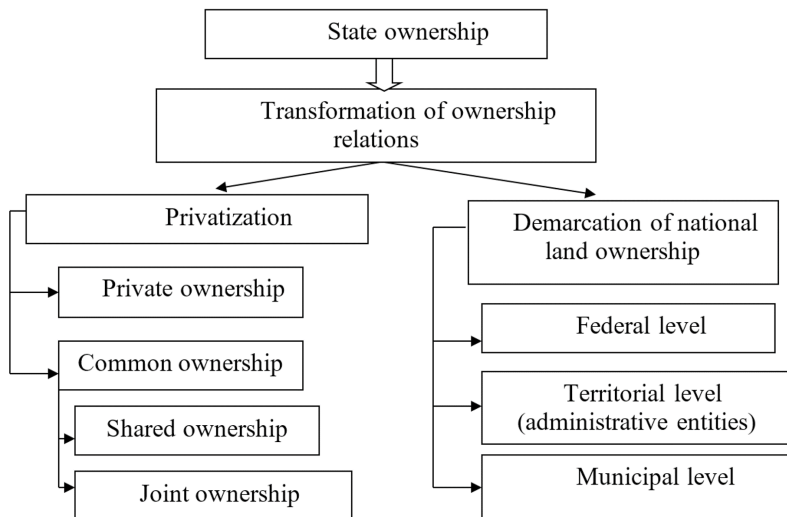
Source: Authors' development

Nevertheless, the success of the reform has not eliminated problems in the field of land relations, the unresolved nature of which hinders the sustainable economic development of the agricultural sector today. Our analysis allowed us to define six core problems of contemporary land relations in Russia:

1. The lack of a clear land policy. No principles, content, or directions of land relations development have been comprehensively defined. There is no clear position on a number of important issues:

- should land privatization continue, or should the existing ownership structure be preserved, or should land be nationalized;

- whether the state intends to influence the design of land ownership, what it should look like in the future;

- how the state plans to build an effective system for regulating land relations and managing land resources;

- does the state intend to develop land market institutions, and what are its priorities in the field of land turnover;

The structure of land ownership is far from optimal (Table 1). About 67% of all agricultural land remains in state ownership. This portion has decreased by only 2% since the mid-2000s. State-owned lands are those where mismanagement, degradation, overgrowth, waterlogging, and other harmful processes occur the most.

Table 1. Structure of agricultural land ownership

Ownership	2005		2020		Change, %
	million ha	% of total	million ha	% of total	
Individuals	120.7	30.1	106.6	27.9	88.3
Legal entities	5.0	1.2	20.9	5.5	418.0
State (all levels)	275.8	68.7	254.1	66.6	92.1
Total	401.5	100.0	381.7	100.0	95.1

Source: Authors' development based on Rosreestr (2021)

2. No significant changes to the structure of land distribution by a form of management. There is a tendency to reduce the land area of small businesses (Table 2), although the production volume in peasant farms has increased by almost 40% over the past decade.

Table 2. Agricultural land distribution by a form of management

Ownership	2005		2020		Change, %
	million ha	% of total	million ha	% of total	
Agricultural organizations	410.3	91.0	411.0	91.1	100.2
Peasant farm enterprises	26.0	5.8	27.2	6.0	104.6
Individual entrepreneurs	3.4	0.8	3.6	0.8	105.9
Private subsidiary farms and other households	9.7	2.2	8.0	1.8	82.5

Ownership	2005		2020		Change, %
	million ha	% of total	million ha	% of total	
Non-profit organizations	1.2	0.3	1.6	0.3	133.3
Total	450.6	100.0	451.4	100.0	100.2

Source: Authors' development based on Rosreestr (2021)

Small farms produce about 30% of grain, 11% of sugar beet, and 30% of sunflower, with their portion of the total land use of only 5.7%. On the other hand, super-large landholdings continue to proliferate. Realizing the danger of over-concentration of land, developed countries strongly resist this process through anti-trust regulations and diversification policies. In Russia, on the contrary, the government provides the largest agricultural holdings with abundant subsidies.

3. Low share of own land in the use of agricultural organizations. The portion of land owned by agricultural organizations is only 3.8%, while that of land leased from shared ownership and owned by the state is 53.5%. Small businesses own 33.7% of their own land and use 64.2% of leased land (Figure 2).

Figure 2. Composition of agricultural land use by form of ownership, % of total land fund
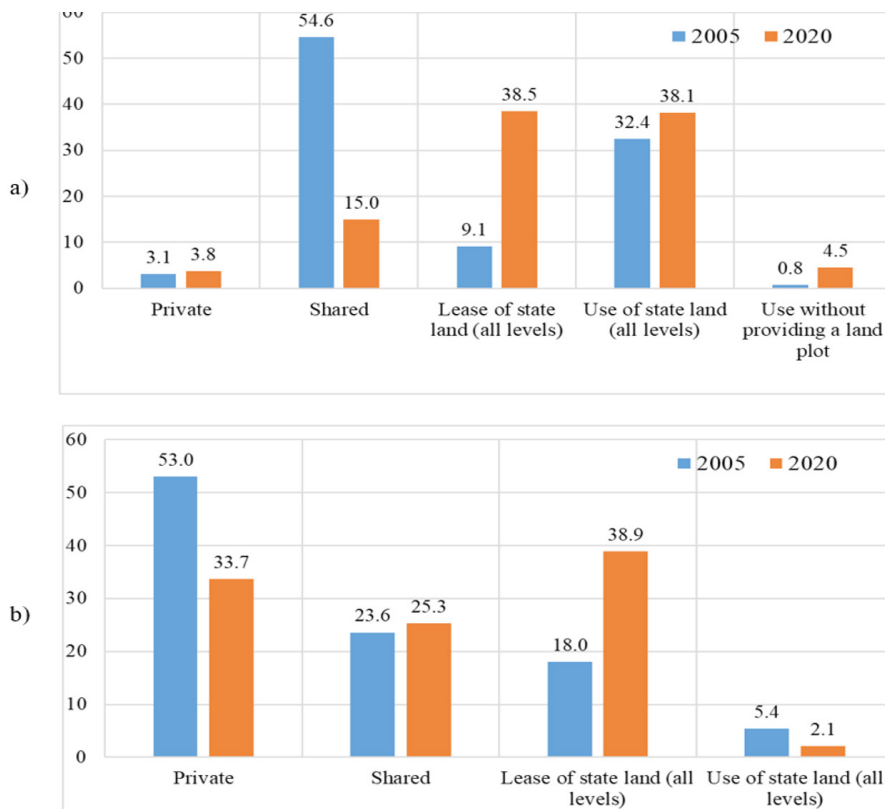
Note: a) agricultural organizations; b) peasant farm enterprises and individual entrepreneurs
Source: Authors' development based on Rosreestr (2021)

Khlystun (2019) reports that about 38% of the land is in the free use by organizations, while about 4.5% or 14.5 million ha is used illegally. Among small businesses, only 2.7% of the land is in legitimate use. The ratio of free land is 10:1, which indicates preferences of local authorities in the free provision of land to large businesses. Land shares were introduced as an institution for equalizing the distribution of agricultural land in their privatization. Initially, the land reform introduced a transition period for land shares (up to two years), during which they had to be transformed into either land plots or shares of the capital of corporate structures. However, they continue to exist, and they have become a significant obstacle to the further development of land ownership and land use since they cause uncertainty about land ownership.

4. Inadequate information on the quantity, structure, and dynamics of the land resources. During the transition period in the early 1990s, the destruction of the land cadastre systems, agricultural cartography, land management, land monitoring, and other information support tools for land management resulted in the lack of information for making management decisions on rational land use. Without establishing the exact boundaries of administrative entities, it is impossible to determine their legitimate jurisdiction to regulate land relations. The objectivity of information about land rights and the spatial characteristics of land plots should be reflected in the documents of the real estate cadastre. Without this, the legality of the use is questioned, which causes land use instability. The cadastre should provide accurate information about the availability, distribution, and condition of land plots.

5. Low efficacy of land management system. There is no single management body that would concentrate all functions, powers, and responsibilities for the organization of use and protection of the land fund in the country. Land regulation powers are divided among several ministries and agencies. The state control over land use and preservation is divided between four control bodies, whose activities are poorly coordinated. The division of powers has destroyed the unified land management system and resulted in a decrease in efficiency of land use forecasting and planning, remote sensing and monitoring, and cartographic support.

6. Acceleration of land degradation processes. The destruction of the institutions in the sphere of land study, land use planning, and land management has also led to the acceleration of water and wind erosion, desertification, salinization, waterlogging, and other negative phenomena. Khlystun (2019) estimates the annual increase in the gully plantings network to exceed twenty thousand km. About half of the total area of arable land is subject to water erosion to varying degrees. According to Rosreestr (2021), water erosion affects 17.8% of the total area of agricultural land, wind erosion – 8.4%, waterlogging – 12.3%, and salinization – 20.1%.

These findings indicate the need for a significant adjustment of the land policy. In our view, the following measures could be implemented:

- development and adoption of a fundamental document in the form of a state land policy doctrine;

- formation of a land management system based on the re-establishment of a single body for regulation of land relations and organization of rational use and protection of agricultural land;

- re-establishment of institutions in such spheres of land use and protection of land resources as forecasting and planning, land management, land monitoring, and exploration and evaluation of land potential);

- carrying out a comprehensive inventory of agricultural land;

- establishment of an effective system to combat land degradation;

- anti-trust regulations to prevent concentration of land in mega-holdings (setting a limit on the size of the estates, lower support for extra-large estates, differential taxation);

- establishment of a system of information and consulting support for rational use and protection of agricultural land.

The above-defined measures can be integrated into a system of land management (Figure 3).

Figure 3. Measures of agricultural land management in Russia
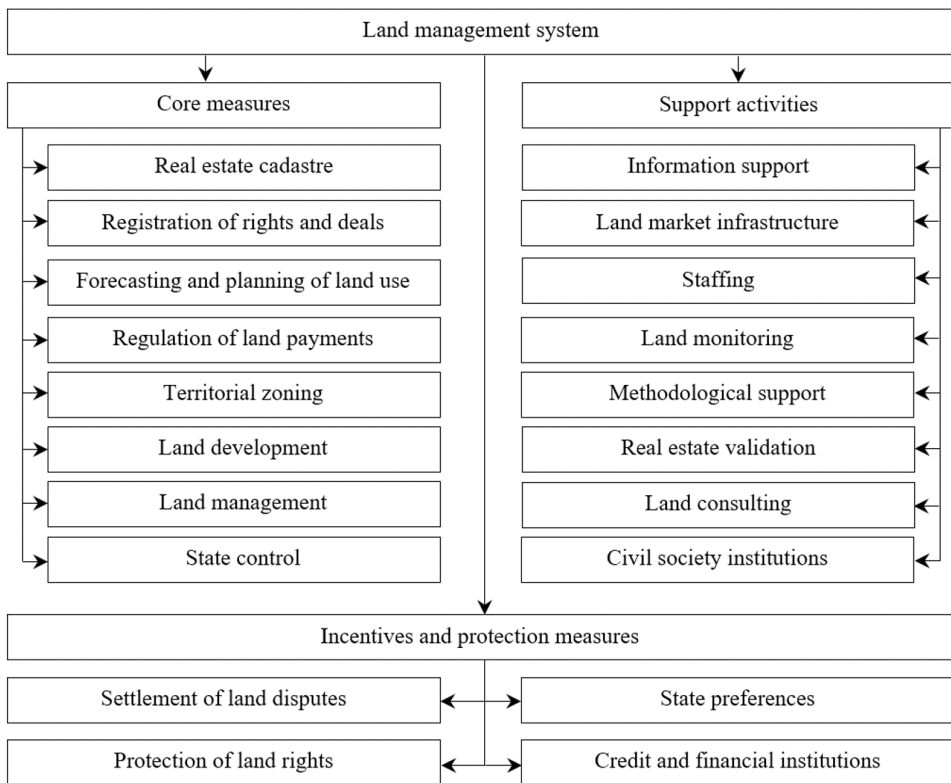
Source: Authors' development

In our vision, such a system should include three blocks of measures: core measures, support activities, and incentives. The system is founded on the integration of institutions and tools that operate within a single concept. They are closely related to each other and work towards achieving common goals. Each block in the system should have methodological autonomy while respecting the established methodological approaches. A unique role in the proposed system belongs to land management as the primary tool for managing the processes of land redistribution, eliminating land use deficiencies, organizing agricultural production facilities, and developing programs and projects to prevent soil erosion and desertification.

Discussions

The results of our research allow us to define critical challenges to the development of agricultural land use, which are the irrational intersectoral redistribution of agricultural land, unregulated market turnover of agricultural land, and inefficient use of land in agricultural production. These findings well agree with many Russia-related studies in the sphere of land relations and land reform, including Dugina (2015), Mindrin and Leppke (2008), Kuzmich and Gorr (2016), Bryzhko (2013), Erokhin et al. (2020b), and Zavorotin et al. (2019a), among others. As a result, there has been a gradual decrease in productive land, a decline in crop yields, the use of highly fertile lands as less valuable land categories, and land degradation. These negative processes cause severe damage to both the agricultural sector and the country's economy as a whole. As demonstrated by Dugina (2015), Khlystun (2019), Saifidinov and Kostousova (2019), and Sergeeva (2019), the main reasons for the degradation of the land and resource potential in the agricultural sector are related to social, economic, and organizational factors. These include territorial uncertainty and instability of agricultural land users, underestimation of the role of agrotechnical, anti-erosion, and other measures in increasing land productivity, and unjustified land seizures for non-agriculture needs.

Internationally, land has been increasingly important as an object of management and economic activity rather than property. In the sphere of property rights, land legislation in Russia pursues outdated approaches, while in most of the developed countries, governments are increasingly taking on control functions in land markets (Dugina, 2015). According to many authors, including Scott et al. (2019), Kim (2019), Volkov et al. (2020), and Cai et al. (2020), the principle that the state restricts the rights of a landowner in favor of society or anyone who cultivates the land, is reasonable, since it relieves social tensions. Kuzmich and Gorr (2016) believe that the successful completion of land reform with the emergence of effective landowners is possible only due to the active position of the state, which provides for the use of available administrative and financial resources.

Diversifying land ownership and land tenure in establishing a sustainable land-use system is pivotal. A significant portion of agricultural output in Russia (primarily, in animal husbandry) is provided by private subsidiary households and small farms. However, it is problematic for a small farmer to establish its own distribution, processing,

or at least storage of agricultural products. As a consequence, the added value is washed out of the agricultural complex and is redistributed in favor of intermediaries (processors or traders) (Minakov, 2017). The solution to this problem could be creating an infrastructure to promote the products of small farms jointly owned by producers themselves, i.e., agricultural cooperatives. Since 2005, the number of cooperatives in Russia has decreased by more than one-third, which can be explained by their low investment attractiveness. Investors are not interested in developing this form of agricultural production, while rural people have no funds of their own. Furthermore, most of the cooperatives work on leased land rather than on their own land, which also reduces the investment attractiveness. To develop cooperation as a condition for the full involvement of small farms in the effective land-use system, it is necessary to improve the methods and tools of state support to assist in creating cooperatives' material and technical capacities. The intensification of agriculture will improve the economic efficiency of agricultural cooperatives as alternative users of agricultural land.

Thus, it can be stated that the development of the agricultural sector in Russia should be supported by the elaboration of a strategy for improving the system of land relations through effective land use, public regulation and administration of the land market, and innovations. Our understanding is that land policy should clearly set goals, priorities, and tools for regulating land relations, the implementation of which will radically refocus the development on preserving and increasing the land potential. The primary goals of such policy could include:

- Completing the establishment of a system of land ownership and land use that fully ensures the implementation and protection of land rights of individuals, agricultural organizations, and public bodies to acquire and facilitate the rational use of land plots.

- Establishment of a civilized land market along with its infrastructure.

- Development of conditions and incentives for the rational and efficient use of land to meet the needs and interests of landholders, administrative entities, and the state.

- Protection of the country's land resources from degradation and mismanagement.

The perspective of the agricultural sector of the economy is closely linked to the decision on the future of land shares. The primary and necessary condition for the efficacy of agricultural land use is the stability of land rights. This principle ensures the development and strengthening of the interest in investing labor and money in land, a careful and economic attitude to land, and increasing soil fertility. The sustainability of a particular land use pattern is expressed in the long-term or permanent nature of land use. Currently, most of the agricultural land is formally owned by rural dwellers, and there is still no legal clarity on the allocation and use of these lands. The boundaries of land shares are not established even in the planning and cartographic documents. The main problem is the high cost of registration and the difficulty of making transactions.

For the same reason, the number of unclaimed land shares is growing.

Different opinions about the formation of land use of agricultural organizations coexist in the economic literature. According to Mindrin and Leppke (2008), the economic mechanism of the transition of land shares should provide employees of agricultural enterprises with an opportunity to acquire them. The uncertainty of the legal situation entails the instability of land use, and, accordingly, agricultural production. It seems to us that the problem can be solved only by establishing long-term legal and industrial relations between agricultural enterprises and land share owners. This vision agrees with Kuzmich and Gorr (2016), who advocate mandatory public management and regulation of land redistribution and use. The priority measures to improve public management of agricultural lands should include:

- complete inventory of agricultural land and its cadastral registration;

- qualitative agrochemical survey of productive land necessary for assessing soil fertility and monitoring its reproduction;

- continuous monitoring of soil fertility and the development of measures to stimulate its reproduction;

- targeted use of agricultural land and encouraging the involvement of abandoned and uncultivated land in economic turnover;

- control over agricultural land turnover;

- ensuring transparency of transactions with land owned by the federal, regional, and municipal authorities;

- preventing purchases of agricultural land by foreign legal entities and individuals.

As demonstrated by Bryzhko (2013), Khlystun (2019), Kalugina (2019), Vishkaev and Musaev (2019), Vlasov et al. (2019), and Sharipov et al. (2018), among others, sustainable development of agricultural land use requires a comprehensive organizational and economic mechanism focused on improving the system of redistribution of land resources between industries, market turnover of agricultural land, the use of productive land in agriculture, and the practice of public management of agricultural lands. It is necessary to strengthen the priority of agricultural use of lands in order to sustain the territorial basis of agricultural production (Erokhin et al., 2020b). In particular, legal, administrative, and economic incentives for the rational use of land resources should be improved. Of great importance is the involvement of unused land in the turnover, a significant part of which is represented by unclaimed land shares as part of agricultural land (Gao et al., 2018).

Conclusions

The systematic and scientifically-based land policy is designated to create prerequisites for improving the efficiency of the use of productive land, increasing the volume of agricultural production, ensuring the food security of the country, and creating the

potential for rural development. Implementing an adequate land policy involves a set of strategic directions that allow creating conditions for preserving agricultural land, involving them in economic turnover, and preventing land degradation and pollution.

In this study, the authors attempted to analyze the most critical challenges in the sphere of agricultural land distribution in Russia and suggest ways to improve the efficiency of land ownership and land use patterns. The land ownership relations patterns were studied regarding the transformation of ownership relations, privatization, and demarcation of land ownership. The problems of land relations in Russia were identified by studying such parameters as the structure of agricultural land ownership, agricultural land distribution by a form of management, and composition of agricultural land use by a form of ownership.

We summarized the major problems of contemporary land relations in Russia to be the lack of a clear land policy, insignificant changes to the structure of land distribution by a form of management, low share of owned land in the use of agricultural organizations, inadequate information on the quantity, structure, and dynamics of the land resources, low efficacy of land management system, and aggravation of land degradation processes. The prospective measures to improve the efficiency of land ownership and land use patterns could be built along the core, support, incentive, and protection blocks of the land management system to include the unification of the land policy doctrine, re-establishment of a single body for regulation of land relations and rational land use, carrying out a comprehensive inventory of agricultural land, establishment of an effective system to combat land degradation, anti-trust regulations to prevent concentration of land in mega-holdings, and information and consulting support for rational use and protection of agricultural land.

Land distribution, land ownership, and land use issues require comprehensive studies to critically evaluate and adjust the land management measures to territorial specifics of the land market in various parts of the country. To our mind, the future research directions in this area should include the elaboration of a thorough methodology for strategic forecasting and planning of land use and protection of land resources; establishment of a system of information support for land management; scientific justification and development of a set of measures for the development of the agricultural land market infrastructure; engineering of digital models of optimal distribution and use of land plots at federal, regional, and municipal levels; improvement of methods and technologies for the protection and reproduction of agricultural land; and development of technical solutions for monitoring of agricultural land based on remote sensing and GIS technologies.

Conflict of interests

The authors declare no conflict of interest.

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ANALYSIS OF ECONOMIC RESULTS OF DIETARY MEDICINAL PLANTS USAGE IN BROILERS PRODUCTION

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A B S T R A C T

Poultry meat production represents one of the most intensive production in poultry fattening. Broiler's production lasts on average 42 days, which enables quicker income of the employed resources. With the ban of dietary antibiotics usage in poultry meat production, new natural feed additives had to been engaged. This research aimed to investigate the effects of medicinal plants addition to broiler rations on the economic results of the production. Our results have reviled significantly (p<0.05) positive effects. Chickens on medicinal plants (T1) addition have recoded much higher total benefit at the end of production (698.1 €) than chickens on control (T2) treatment (335.6 €). Following the same tendency, the benefit per chicken was also higher in medicinal plant treatment (0.15:0.07 €) and profitability (8.01:3.59%). Upon the gained results, it can be assumed that usage of dietary, medicinal plants expresses a beneficial effect on the monitored economic parameters compared to broilers fed with commercial compound mixtures.

Introduction

Over the last few years, medicinal plants as dietary supplement prices have been reduced primarily because of many competitors appearing in the marketplace (Puvača et al., 2020). Nevertheless, in long run, we can predict that the price of main nutrients sources used in daily animal nutrition stays high (Popović et al., 2018). In order to enhance poultry performance in the future additional endeavors will be needed

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to indorse production, health, and welfare (Puvača et al., 2016). In the last decade, there is a strong tension towards the usage of antibiotics in animal production and their reduction in order to avoid antimicrobial resistance and emergence of harmful pathogens which is in the correlations with consumer's safety (Reisch et al., 2013). These issues include the return of each element in the trade group concerning animal production at the same time as continuing to focus on consumer needs (Croxton et al., 2001). All these difficult circumstances are not easy to achieve. It is important to enhance that economic and social breadth, besides productivity in the production chain represents a serious problem (Ćirić et al., 2015; Lovarelli et al., 2020; Tasić, 2018). Nowadays in the EU economical frame, the greatest obstacle in the development presents a production of positive financial results, and the producers are faced to search their way out for longstanding continued existence (Kuckertz et al., 2020). There have been several proposed solutions over the years for fixing the burning problem of dietary performance optimization, but the only successful solution proposed are multi-level (Guo et al., 2020). Based on all mentioned, it is necessary to propose a new nutritional concept as soon as possible.

Usage of dietary approaches to enhance the quality of the final product for human consumption such as meat is a comparatively innovative method which appeared in the last years (Woods et al., 2020). Latest it has been scientifically proven that dietary approaches represent a valuable solution in the improvement of meat quality (Cardoso-Ugarte & Sosa-Morales, 2021). The quality of meat is significant because broiler meat is often consumed as separate parts of whole carcass rather than as whole carcasses (Puvača et al., 2018). The most important parameters of broiler meat quality include pH and color. Reduce of pH in muscle is related to the most important parameter of meat quality. Precipitous reduction of pH in meat leads to a pale, soft, and exudative meat with decreased water holding capacity (Baldi et al., 2021).

Over the years, dietary antibiotics in poultry production have served as an excellent tool for growth promotion and prevention of disease (Puvača & de Llanos Frutos, 2021). However, since of the bio-security pressures for population health, which come from mounting resistance of pathogens to antibiotics, there is a worldwide necessity for removal of antibiotics from poultry nutrition. The poultry industry's intensive broiler production sector is eager to maximize performance and reduce economic losses caused by the removal of antimicrobial growth promoters, as well as to guarantee the safety of broiler meat through the control or elimination of foodborne infections (Andleeb et al., 2020). In several scientific studies, the positive potential of different microorganisms and bioactive substances in improving animal performance and health has been emphasized (Misra et al., 2021). Illustrations involve mainly natural alternatives such as probiotics, organic acids, enzymes, and medicinal plants. The majority of medicinal plants' beneficial effects are derived from their bioactive molecules. The natural activities of medicinal plants constitute are well recorded, as are their other essential roles, as many other beneficial properties. At the moment, there is a growing concern about natural products used

in poultry daily diets (Aćimović et al., 2020). Medicinal plants, herbs, and spices are listed among the most researched natural additives in poultry nutrition, not only in powder form or as essential oils extracts but also as homogenized multiple forms (Popović et al., 2018).

This paper aimed to determine the effects of medicinal plants and on the economic aspects of broilers.

Materials and methods

Firstly, the biological experiment was performed on a 10,000 broiler chickens. Chickens were distributed on two dietary groups (T1 and T2) and fed under the same conditions. Broilers were fed with the addition of medicinal plants mixture in concertation of 1% (T1), and with a commercial feed mixture as a control treatment (T2). Broiler's productions lasted 42 days. A floor fattening system was used, and environmental conditions were following Hubbard hybrid specifications. Estimate of the cost for feed mixtures has been obtained giving to the requirement of expenditures for the formulation of compound feed mixtures. The expenditure for other resources has been determined giving to the expenditure made on the experimental farm following the sell prices in the marketplace. Assets into infrastructures and equipment have been determined based on basic assets. Fees for wages were determined following realized expenditures. Expenditures for the energy utilization were determined based on the realized expenditure of the fossil fuel and electric energy. An estimate of the revenue was established on the interpretation of revenue from the production, where the economic result gives the revenue from the complete poultry production.

Results and Discussions

The leading production indicators are given in Table 1. From the data presented in the given table and Figure 1, minor feed expenditure with the dietary addition of medicinal plants can be seen. Increased chickens' weight was also noticed at the end of 42 day fattening period in treatment T1, compared with treatment T2. The difference in the final body weight of chickens was statistically significant (p<0.05).

Evaluation of total financial values of broiler chickens eg., meat production begins with the evaluation of venture into the objects for rearing with all associated equipment. The investment into the broilers' production objects and equipment amount is approximately 70,000 €. An estimate of other expenses such as human labor used energy, and additional materials have been obtained for each production cycle of broiler chickens. The allocation was divided evenly to the starting number of broilers bring to the farm, e.g., two equal dietary treatments.

Table 1. Basic production results (Cost per unit, €)

Category	Dietary treatments			
	T1		T2	
	Units / Cost, €		Units / Cost, €	
Broilers	5,000	0.38	5,000	0.38
Produced broilers	4,800	1.40	4,935	1.40
Produced broilers (kg)	6,720	9,408.0	6,909	9,672.6
Kg/Broilers	2.31		2.55	
Total feed consumption (kg)	11,088		12,584.3	
Starter (kg)	2,112	0.40	2,368.8	0.40
Grover (kg)	10,800	0.38	11,350.5	0.38
Finisher (kg)	6,192	0.36	7,106.4	0.36
Feed conversion ratio (kg/kg)	2.1		1.8	

Total basic production cost has been shown in Figure 1, while obtained estimates established of the expenditure and the cost of the fattening chicken have been presented in Table 2.

Figure 1. Total basic production cost, €
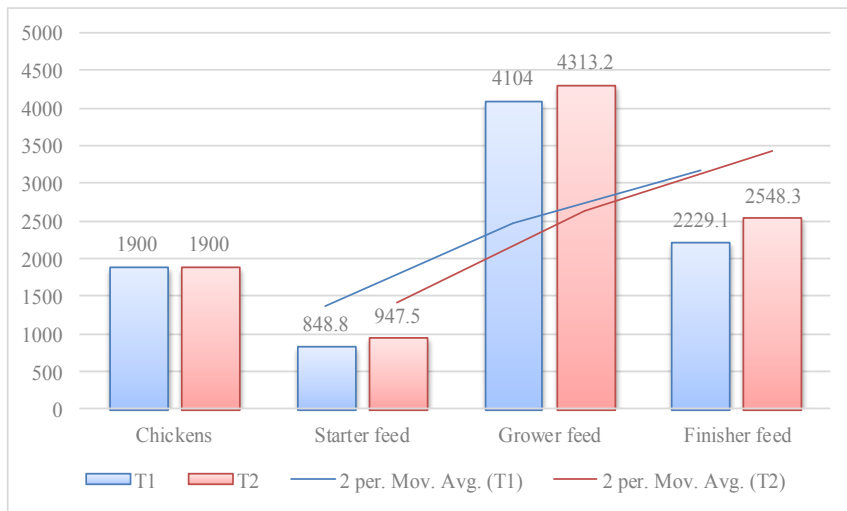
Source: Authors' calculations

Table 2. Calculation of the total expenses, €

Category	Dietary treatments	
	T1	T2
Feed	7,181.9	7,809.0
Amortization	700.0	700.0
Salaries	400.0	400.0
Energy	378.0	378.0
Additional materials	50.0	50.0
Total	8,709.9	9,337.0

The income was calculated, including the incomes which farm was achieved based on the sale of chickens. The price for the chickens on 42nd day of the fattening period was 1.40 €/kg. Following the number of fattened broilers and the selling amount, the estimations of the total revenue was made. Observed revenue was 9498.0 € for the group fed a diet with dietary addition of medicinal plants and 9672.6 € for the control treatment of chickens. The gain was determined as a discrepancy among the revenue and expenditure (Table 3). The benefit achieved per one productive cycle was 698.1 € for the chickens in treatment with the addition of medicinal plants and 335.6 € for the control treatment, e.g., 0.15 € and 0.07 € per produced broiler. If the realized gain is determined per kilogram of produced broilers, 0.05 €/kg was achieved in the control treatment and 0.10 €/kg in the treatment with dietary addition of medicinal plants T1. The economy determined from the ratio of total revenue and total expenditures were 1.08 (T1) and 1.04 (T2).

Table 3. Cost-effectiveness calculation of production, %

Indicators	Dietary treatments	
	T1	**T2**
Total expenses	8,709.9	9,337.0
Total income	9,408.0	9,672.6
Benefit	698.1	335.6
Benefit per broiler	0.15	0.07
Benefit per kg	0.10	0.05
Economy	1.08	1.04
Profitability, %	8.01	3.59

The effectiveness of the production is achieved based on the relative amount of accomplished profit and total investing. The total investing incorporates investments into the production of farm objects and equipment. The effectiveness of the total production process in the observed case is not difficult to calculate since the production is intensive in control conditions and is realized in one production cycle. Realized effectiveness for the treatment fed with dietary addition of medicinal plants was 8.01% and 3.59% for the control treatment fed with the standard commercial dietary mixture.

Regarding our obtained results in this investigation, comparable research investigating the influence of natural alternatives to antibiotic drugs in poultry production has shown promising results. The investigation of Talpaz et al. (2013) demonstrates that the capacity to calculate the optimal density of chicken compound feed to optimize feeding margins offers a significant economic impact. According to the same study, in order to determine the optimal feed nutritional content, component costs, market meat costs, marketing, and availability of biological efficiency of chicken products must be considered. Our results have shown that the inclusion of dietary medicinal plants has good and positive influence on the chicken's diet, suggesting that a reduction in some nutrients in the dietary combination be considered. Studies have demonstrated that supplementing a basic meal with 1% mint leaves reduces feed cost/kg of live body weight growth in broiler chickens (Puvača et al., 2020). Furthermore, the findings of

other authors' assessments of the net profit in the economic research, revenue, and total cost revealed that a blend of dietary medicinal plants in the broilers diet had maximum profitability in comparison to diets lacking herbal ingredients.

Conclusions

Production effectiveness is fundamental principle and the foundation of rational business in a market economy, and it is increasingly becoming a need for production in our economy. A thorough examination of economic metrics reveals that the production is profitable. The realized production effectiveness makes 8.01% for the treatment fed with medicinal plants and 3.59% for the control treatment. Regardless, all of the evidence offered supports the use of medicinal herbs in broiler meat production.

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Conflict of interests

The authors declare no conflict of interest.

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GENERATION Z CONSUMERS' MOTIVES AND BARRIERS TO PURCHASING ORGANIC FOOD PRODUCTS IN SERBIA

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A R T I C L E I N F O	A B S T R A C T
	The aim of this study is to identify and analyze the main motives and barriers for purchasing organic food in the Generation Z market segment in Serbia. A quantitative study was conducted through a survey questionnaire filled out by 213 students from three universities. The results are based on descriptive statistics, the independent samples t-test and the analysis of variance. Quality and health protection and improvement are identified as the primary motives for purchasing organic food, proving that egoistic motives prevail over altruistic ones. The most important barriers hindering organic food consumption are high price, lack of information, and limited availability. The willingness of Generation Z members to accept high market prices for organic food depends on their monthly household income. These findings could be used by organic food producers and retailers to predict buying behavior and adapt their promotional activities on the Serbian market.

Introduction

The world's organic food and drink retail sector reached a value of 106.4 billion euros in 2019 (US 44.7 billion €, Germany 12.0 billion €, France 11.3 billion €). The greatest per capita consumption of organic food was noted in Denmark (344 €), Switzerland (338 €), and Luxembourg (265 €) (Willer et al., 2021). Unlike the markets of more developed European countries, the organic food market in Serbia is in its initial stages of development. In 2019, the area of 21,265 ha (0.6% of utilized agricultural area) and over 6,000 producers (including cooperants from group production) were engaged in organic production in Serbia. From 2012 to 2019 the organic agricultural area tripled (MAFWM, 2019a). Almost 90% of the total 513 organic certificate holders produce plant products, while only 10% opted for animal products (MAFWM, 2019b). Most of the national organic production is focused on export, amounting to 27,4 million euros

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in 2018. The main export markets for producers from Serbia are Germany, Holland, Austria, and Italy (MAFWM, 2018).

There are various motives for purchasing organic food, such as health protection, food safety, environmental protection and ethical motives, but there are also specific product attributes that contribute to them, such as taste, freshness and appearance.

Numerous studies identified health as the primary motive for purchasing and consuming organic food (Hutchins & Greenhalgh, 1997; Chinnici et al., 2002; Magnusson et al. 2003; Padel & Foster, 2005; Radman, 2005; Roitner-Schoesberger et al., 2008; Liu et al., 2013; Bryla, 2016). Consumers often claim that organic products are healthier than conventional products, which is why they believe that organic food is richer in vitamins and nutrients (Hill & Lynchehaun, 2002; Zagata, 2012). Also, we can expect that the pandemic will result in an additional increase in demand for nutritively rich organic/healthy food that contributes to strengthening the immune system.

Food safety was identified as the main reason for purchasing organic food in several studies (Schifferstein & Oude Ophuis, 1998; Michaelidou & Hassan, 2008; Sondhi, 2014; Teng & Lu, 2016). Caring about food safety is especially important for new parents who purchase organic food motivated by a feeling of responsibility for their children (Hartman Group, 2010, pp. 8-9). In addition, food safety concerns have a significant effect on the attitudes and buying intentions of occasional consumers (Pino, et al. 2012).

After health protection, caring about the environment is the most frequently cited reason for consuming organic food (Davies, et al., 1995; De Magistris & Gracia, 2008; González, 2009; Nikolić et al., 2014; Xie et al., 2015; Janssen, 2018). Considering that organic production precludes the use of pesticides and other pollutants, consumers perceive methods of organic production to be environmentally friendly (Jolly, 1991; Roitner-Schobesberger et al., 2008; Hoefkens et al., 2009). Wandel and Bugge (1997) point out that younger consumers choose organic products more based on ecological motives, while older consumers are more influenced by care about their health. Certain studies indicate that consumers purchase organic food because they believe it is better for animal welfare, while it simultaneously supports the local economy (Essoussi & Zahaf, 2008; Sangkumchaliang & Huang, 2012; Moser, 2016; Schrank & Running, 2018).

The decision to purchase organic food could be influenced by product attributes such as taste, appearance, and freshness (Zepeda et al., 2006; Zakowska-Biemans, 2011; Vukasovič, 2016). Taste is the main motive for the consumption of organic food in Sweden, Italy and Holland (Magnusson et al., 2001; Zanoli & Naspeti, 2002; Stobbelaar et al., 2007). Taste and freshness significantly increase the intent to purchase organic food (Wier et al., 2008). Appearance is especially important for occasional buyers who would like the organic food that they purchase to be tasty, but also have an appealing appearance (Zanoli & Naspeti, 2002).

Barriers which hinder organic food consumption include high prices, limited availability, satisfaction with conventional food and lack of trust in organic products.

Numerous studies discovered that the high price of organic food is the major obstacle to its purchase (Tregear et al., 1994; Magnusson et al., 2001; Chinnici et al., 2002; Zagata, 2014; Vega-Zamora et al., 2014; Janssen, 2018). Such findings have motivated many authors to study the willingness of consumers to pay for organic food. Pellegrini and Farinello (2009) estimate that Italian consumers are willing to pay a 20% to 40% greater price for organic eggs and cookies and Tsakiridou et al. (2006) that consumers in Greece a 35% higher price for various organic products when compared to the price of conventional products. Some studies calculate price elasticities for organic food and find that the demand for organic milk decreases with the increase in its price (Jones & Rosen, 2008; Alviola & Capps, 2010).

The next most frequently cited barrier to purchasing organic food is limited availability (Gonzalez, 2009; Jensen et al. 2011; Pomsanam et al. 2014; Bryla, 2018). In emerging markets, consumers cite that they are not satisfied with the number of purchase points for organic food, and that they are willing to purchase more organic food if its availability were to increase (Cerjak et al. 2010; Zakowska-Biemans, 2011). Consumers in the US also believe that the variety of organic products is smaller compared to conventional products found in supermarkets and at other purchase points (Govindasamy et al., 2006). There are consumers who do not purchase organic food because they are satisfied with conventional food (Botonaki et al., 2006) while numerous consumers are still struggling with recognizing organic products and are skeptical about the credibility of certification systems (Tung et al., 2012; Chen et al., 2014; Brusci et al., 2015).

Most studies on organic food consumer behavior have focused on Generation Y/the Millennials (Molinillo et al., 2020; Leerattanakorn, 2017; Muposhi et al., 2015; Thambiah et al., 2015; Regine, 2011). Unlike the Millennials, Generation Z is understudied in terms of organic food buying behavior. Generation Z includes individuals born in the period 1995-2012 and they make up 32% of the world's 7.7 billion global population (Manghiuc & Petrescu, 2020, p. 418). Generation Z knows more about a sustainable way of life than previous generations, and exhibit a strong sense of social responsibility (Su et al., 2019). When making decisions on their choice of food they prioritize their health and quality of life and are willing to pay premium price for food which they perceive to be healthier (Nielsen, 2015).

Bearing in mind the low consumption of organic food in Serbia and the fact that Generation Z represents a sustainable food market segment, the aim of this study was to discover the most important motives and barriers which affect the consumption of organic food among members of Generation Z in Serbia, in order to select and implement the most appropriate marketing strategies for them, primarily the marketing communications strategies.

Materials and methods

In order to realize the above aim, the following research questions were formulated:

- What are the main motives for purchasing organic food among Generation Z consumers? How much has the hierarchy of motives determined in this study changed compared to previous research carried out in Serbia? Does Generation Z assign greater importance to egoistic motives than to altruistic motives? Is there a significant difference between the noted motives in terms of the gender and income characteristics of the respondents?

- What are the main barriers hindering young consumers from purchasing organic food, or hindering them from purchasing greater amounts of it? Are members of Generation Z sensitive to the higher price of organic food? How much has the importance of certain barriers changed compared to previous research carried out in Serbia? Is there a significant difference between the noted barriers in terms of the gender and income characteristics of the respondents?

Study was realized using a structured questionnaire based on a literature review and previous studies on the motivation of organic food consumers in Serbia (Vehapi, 2015). A survey conducted in 2019, which included a sample of 213 students from three universities from Serbia, was used for data collection. The students who participated in the research were enrolled in the third or fourth year of their studies, which means that they were born in 1997 or 1998. The structure of the sample is shown in Table 1.

Table 1. The structure of the sample

Characteristics of respondents		Number of respondents	% of respondents
	Total	213	100
Gender	Female	146	68.5
	Male	67	31.5
Location	Large city	77	36.2
	Suburb of a large city	37	17.4
	Medium or small city	72	33.8
	Rural area	27	12.7
Household income	No income	4	1.9
	Less than 50.000 RSD	34	16.0
	Between 50.000 and 100.000 RSD	79	37.1
	Between 100.000 and 150.000 RSD	55	25.8
	Between 150.000 and 200.000 RSD	24	11.3
	More than 200.000 RSD	17	8.0
Size of a household	One member	3	1.4
	Two members	15	7.0
	Three members	33	15.5
	Four members	83	39.0
	Five members	48	22.5
	Six members and more	31	14.5

Characteristics of respondents		Number of respondents	% of respondents
Number of children under 12 years age in household	No children	188	88.3
	One child	17	8.0
	Two children	4	1.9
	Three children	3	1.4
	Four and more children	1	0.5

The questionnaire included 3 segments related to 1) demographic characteristics of the respondents and their 2) motives and 3) barriers for purchasing organic food. The respondents (187 consumers who had stated that they were familiar with organic food and that they purchased organic food products) were asked to, on a five-point Likert-type scale, evaluate the importance of the following ten motives: health protection, environmental protection, safety, quality, taste, freshness, absence of pesticides and GMO, animal welfare, preserving resources for future generations, and support for the local/small farmers. Then, 206 respondents familiar with organic food, both consumers and those who do not purchase organic food, had the task to evaluate, on a five-point Likert-type scale, the importance of the following seven barriers: high price, limited availability, less appealing appearance, mistrust in organic labels, limited offer, lack of information, and lack of interest. The results are based on descriptive statistics, the independent samples t-test and the analysis of variance (ANOVA).

Results and discussions

The main motives for purchasing organic food

The results indicated that Quality (4.27) and Health protection (4.25) were the main motives for purchasing organic food among Serbian Generation Z consumers, followed by the remaining dimensions of quality such as Absence of pesticides and GMO (4.16), Freshness (4.02) and Taste (3.58). Environmental protection (3.33), along with Animal welfare (3.32) and Preserving resources for future generations (3.12), were low-ranked motives for purchasing organic food on the national market of young consumers (Table 2).

Table 2. Hierarchy of motives for purchasing organic food

	Motives	Mean
1	Quality	4.27
2	Health protection	4.25
3	Absence of pesticides and GMO	4.16
4	Freshness	4.02
5	Taste	3.58
6	Safety	3.53
7	Support for the local/small farmers	3.43
8	Environmental protection	3.33
9	Animal welfare	3.32
10	Preserving resources for future generationS	3.12

These results are mostly congruent with the results of previous studies carried out on the market in Serbia, with the addition that previous studies listed quality as the second most important motive for consuming organic food, after health (Vlahović et al, 2011; Vehapi, 2015; Vlahović & Šojić, 2016; Ćendić & Zarić, 2019). According to Grubor and Đokić (2016), consumers who prefer organic food are aware of the importance of food for health and believe that a proper diet could help prevent illness.

Low-ranked environmental protection and ethical motives indicate that Serbian Z generation consumers assign greater importance to egoistic motives compared to altruistic ones. The advantage of egoistic motives over altruistic ones was proven in other studies (Padel & Foster, 2005; Durham & Andrade, 2005), but these motives coexist to various extents, depending on the country. Generation Z from developed countries shows significant interest for ecological issues, green consumption and green products (Kitchen & Proctor, 2015), which is not the case in Serbia.

The Independent samples t-test was used to compare the results obtained for the motives of men and women. The results of the T-test indicate a statistically significant difference between male and female organic food consumers in the case of one variable, and that is Animal welfare (t=-2.360; p=0.019). Female organic food consumers (M=3.46) are more motivated by Animal welfare than male consumers (M=3.00) (Table 3). Despite the statistical significance, the actual difference between the means of the groups is small (Eta-squared=0.04).

Table 3. T-tests for Purchasing Motives and Gender

Dependent Variable	Gender				t-value	Sig.
	Male		Female			
	Mean	Std. Dev.	Mean	Std. Dev.		
Health protection	4.07	1.197	4.33	0.782	-1.495	0.139
Environmental protection	3.17	1.201	3.40	1.101	-1.288	0.199
Safety	3.41	1.093	3.58	1.150	-0.936	0.351
Quality	4.12	1.044	4.33	0.700	-1.637	0.103
Taste	3.50	1.174	3.61	1.091	-0.645	0.520
Freshness	4.00	0.937	4.03	0.951	-0.207	0.836
Absence of pesticides and GMO	4.14	1.099	4.16	0.950	-0.157	0.875
Animal welfare	3.00	1.325	3.46	1.179	-2.360	0.019
Preserving resources for future generations	2.98	1.235	3.19	1.273	-1.019	0.309
Support for the local/ small farmers	3.43	1.244	3.43	1.242	0.024	0.981

Similar findings were presented by Stobbelaar et al. (2007), which proves that women assign greater importance to the association between organic food and animal welfare. For example, women are more sensitive to animal welfare aspects when purchasing fresh beef meat (Blanc et al., 2020).

In order to determine whether there are any statistically significant differences between the means of the dependent variables in terms of the monthly household income, a One-Way ANOVA was calculated. The results of the One-Way ANOVA tests indicate that

there is a statistically significant difference between consumers of organic food with different monthly household incomes regarding variables such as:

- Environmental protection (F=2.422; p=0.037) – subsequent comparisons through Tukey's HSD test indicate that the means of group 3 (M=3.49) differ significantly from the means of group 6 (M=2.50), and

- Preserving resources for future generations (F=2.416; p=0.038) – the results of Tukey's HSD test indicate that the means of group 6 (M=2.07) differ significantly from the means of group 3 (M=3.30) and group 4 (M=3.21) (Table 4).

Table 4. One-Way ANOVA tests for Purchasing Motives and Household Income

Dependent Variable	Mean						F	Sig.
	1. No income	2. <50.000	3. 50.000-100.000	4. 100.000-150.000	5. 150.000-200.000	6. >200.000		
Health	4.00	4.14	4.29	4.33	4.25	4.00	0.419	0.835
Environmental protection	2.50	3.32	3.49	3.44	3.25	2.50	2.422	0.037
Safety	3.25	3.61	3.61	3.65	3.45	2.71	1.774	0.120
Quality	5.00	4.11	4.32	4.25	4.05	4.50	1.416	0.220
Taste	4.00	3.21	3.62	3.67	3.53	3.71	0.843	0.521
Freshness	4.50	3.89	4.04	4.12	3.80	4.00	0.635	0.674
Absence of pesticides and GMO	4.50	4.11	4.09	4.37	3.80	4.21	1.160	0.330
Animal welfare	3.00	3.32	3.38	3.46	3.30	2.57	1.245	0.290
Preserving resources for future generations	3.00	3.14	3.30	3.21	3.00	2.07	2.416	0.038
Support for the local/ small farmers	3.75	3.29	3.57	3.38	3.50	3.00	0.651	0.661

Therefore, consumers with a monthly household income greater than 200.000 RSD are less motivated by Environmental protection than consumers with a monthly household income between 50.000 and 100.000 RSD. Also, this income group is less motivated by Preserving resources for future generations than consumers with a monthly household income between 50.000 and 150.000 RSD. The size of these differences, expressed through eta squared, in both cases is 0.06 (a medium effect).

The results obtained are in part concordant with a previous study carried out in Italy, which discovered that consumers with a middle to upper-middle high income are to a greater extent motivated by ecological sustainability, ethical and responsible consumption compared to other categories of consumers (Schifani & Magliore, 2011). However, it is important to point out that our respondents in the majority of cases do not have an independent income, so that the household income probably does not have a direct impact on their motives when purchasing food.

The main barriers to purchasing organic food

According to the survey results, generation Z consumers in Serbia do not purchase organic food, or only purchase limited amounts of it mainly because of High price (3.68), Lack of information (3.45) and Limited availability (3.32) (Table 5).

Table 5. Hierarchy of barriers to purchasing organic food

	Barriers	Mean
1	High price	3.68
2	Lack of information	3.45
3	Limited availability	3.32
4	Limited offer	3.05
5	Mistrust in organic labels	2.67
6	Lack of interest	2.60
7	Less appealing appearance	2.45

Studies carried out in Serbia also point out that the high price is the main reason hindering them from purchasing organic food (Vehapi, 2015; Vlahović & Šojić, 2016; Ćendić & Zarić, 2019). Vapa-Tankosić et al. (2018) measured the willingness to pay premium price for organic food on the national market, and discovered that most respondents are willing to pay 10-20% more for organic products. Studies by other national authors discovered that limited availability is an important barrier for purchasing products on the national market (Vlahović & Šojić, 2016; Ćendić & Zarić, 2019). Generation Z members in Serbia have a higher level of trust in food labels and organic certificates. That is an indication of different attitudes of young consumers toward food labeling compared to previous studies in Serbia, which showed a high level of consumers' skepticism (Žeželj et al., 2012; Mitic & Gligorijević, 2015).

In the following section, we analyzed the differences in the barriers to purchasing organic food with regard to gender and monthly household income. The results of the T-test indicate that there is a statistically significant difference between male and female respondents along two variables, High price (t=-3.501; p=0.001) and Limited availability (t=-2.064; p=0.04). In terms of price, for female respondents a high price (M=3.88) is a more important barrier to purchasing organic food than for male respondents (M=3.22). When it comes to availability, the female respondents (M=3.42) consider limited availability a more important barrier to purchasing organic food than male respondents (M=3.10) (Table 6). In terms of price, the value of eta squared (0.06) indicates that the difference between the means is medium while in terms of availability the difference between the means is small (Eta-squared=0.02).

Table 6. T-tests for Purchasing Barriers and Gender

Dependent Variable	Gender				t-value	Sig.
	Male		Female			
	Mean	Std. Dev.	Mean	Std. Dev.		
High price	3.22	1.325	3.88	1.038	-3.501	0.001
Limited availability	3.10	1.058	3.42	1.031	-2.064	0.040

Dependent Variable	Gender				t-value	Sig.
	Male		Female			
	Mean	Std. Dev.	Mean	Std. Dev.		
Less appealing appearance	2.38	1.142	2.48	1.162	-0.541	0.589
Mistrust in organic labels	2.60	1.289	2.71	1.131	-0.549	0.584
Limited offer	3.13	1.070	3.01	1.187	0.648	0.517
Lack of information	3.49	1.091	3.43	1.172	0.337	0.736
Lack of interest	2.57	1.279	2.61	1.245	0.195	0.846

Similar results were obtained by Bryla (2016) in a study according to which women assign greater importance to barriers such as the expiration date, high price and limited availability. Considering that numerous studies proved that women purchase organic food more often than men, this could be the reason why they are more sensitive to the limited availability and high price of organic food (Davies et al., 1995; Wandel & Bugge, 1997; Radman, 2005).

The One-way ANOVA test results indicate that there is a statistically significant difference among respondents with different monthly household incomes for variables such as High price (F=4.587; p=0.001). Subsequent comparisons using Tukey's HSD test indicate that the means of group 5 (M=2.83) significantly differs from the means of three other groups: group 2 (M=4.15), group 3 (M=3.78), and group 4 (M=3.75) (Table 7).

Table 7. One-Way ANOVA tests for Purchasing Barriers and Household Income

Dependent Variable	Mean						F	Sig.
	1. No income	2. <50.000	3. 50.000-100.000	4. 100.000-150.000	5. 150.000-200.000	6. >200.000		
High price	3.00	4.15	3.78	3.75	2.83	3.33	4.587	0.001
Limited availability	3.00	3.50	3.39	3.08	3.26	3.60	1.155	0.333
Less appealing appearance	3.25	2.76	2.56	2.25	2.17	2.07	2.002	0.080
Mistrust in organic labels	1.50	2.88	2.62	2.60	2.74	2.93	1.237	0.293
Limited offer	2.50	3.24	3.04	3.00	3.13	2.87	0.473	0.796
Lack of information	3.25	3.50	3.48	3.51	3.35	3.20	0.252	0.939
Lack of interest	2.50	2.97	2.42	2.57	2.91	2.33	1.378	0.234

Therefore, for respondents with a monthly household income from 150.000 to 200.000 RSD the high price is less barrier to consuming organic food than for respondents with a lower monthly household income. The size of that difference, expressed through eta squared, is 0.1 which is a significant effect. Similar conclusions were reached by other national authors who pointed out that individuals with a higher monthly income consume organic food more often and are willing to pay a higher price for these products (Đokić & Milićević, 2016; Vapa-Tankosić et al., 2018).

The analysis of the impact of the household size, location, and the presence of children under the age of 12 in the household on the motives and barriers to purchasing organic food did not indicate any statistically significant results.

Conclusions

This study deals with motives and barriers to purchasing organic food products of Generation Z in Serbia. This is the first study that investigates consumer behavior regarding the organic food market of the Z generation cohort in Serbia. The results presented in this paper confirm the dominance of quality and health motives for the purchase of organic products. Generation Z in Serbia expressed low interest in altruistic motives compared to egoistic ones. That is not in line with the research in developed countries where Generation Z members are more interested in ecological issues, sustainable consumption and animal welfare and can indicate that consumers from mature organic markets are more altruistic motivated compared to consumers from emerging organic markets. The main barriers that hinder purchasing organic food on the Generation Z market segment in Serbia are: high price, lack of information, and limited availability. The price and availability are more important to female respondents, who were often recognized as main buyers of organic food. An important contribution of this research represents the finding that members of Generation Z did not express skepticism toward organic labels.

Knowledge of motives and barriers of younger consumers for purchasing organic food is vital for the realization of public policy goals and the creation of marketing strategies. Since quality and health are the dominant motives, promotional campaigns should include opinion leaders, such as doctors and nutritionists, who will testify to the nutritive and health benefits of consuming organic food. Organic food producers are expected to promote various dimensions of quality such as taste, freshness and appearance. It is important to improve the level of information and to educate young consumers, especially women on available channels of distribution and the advantages of organic food consumption. With the aim of decreasing the premium price of organic food, which has been identified as the main purchasing barriers, it is important to stimulate a further increase the volume of organic production through greater subventions for organic producers, to take measures to decrease the costs of certification and to encourage the development of direct marketing channels. Greater production and supply would positively influence the availability of organic food, which is also recognized as one of the important purchasing barriers.

Conflict of interests

The authors declare no conflict of interests.

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THE ROLE OF PHOSPHATES IN AGRICULTURE AND HIGHLIGHTING KEY ISSUES IN AGRICULTURE FROM A CLIMATE CHANGE PERSPECTIVE

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A B S T R A C T

This paper investigates in the foreground the state of agricultural systems in interdependence with climate change, a condition synec vanon of decarbonization of agriculture. The relationship between ecologically responsible agricultural systems places the innovative design of agricultural processes as the first factor in achieving the success of environmental responsibilities in addressing any agricultural processes customized to the area through the symbiosis between production in order to protect the biosphere. Thus, the constraints of reducing the consumption of chemical fertilizers in agriculture have gained new value at the same time as the interest of producers to gradually comply with the new more sustainable environmental requirements by optimizing synergies in the vision of the Common Agricultural Policy (CAP). The paper also identifies the risks of degradation of natural resources as an effect of environmental change, such as phosphorus, a much-needed element in agriculture, a declining global resource. From the empirical analysis of the analyzed sources we followed on the basis of statistical data a calibration of the risk trends generated by the impact of the adaptability of agriculture to environmental requirements, in achieving an agriculture designed for sustainability.

Introduction

The application of sustainable agricultural production may lead to an enlarge in carbon sequestration in soil through proper land management, thus making it feasible to improve its properties and the evolution of soil sequestration C being an important method and a priority.

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The challenge of bringing about changes in agricultural systems is both local and global. However, agricultural productivity is closely linked to possible disasters caused by climate change. Thus, efforts to adapt producers to the impact of adopting the new vision of agricultural policy are becoming more frequent and intense. The first part of the paper brings light on the effects of climate change and the need to adapt agricultural practices responsible for climate and the environment in agricultural structures in order to reduce greenhouse gas emissions. In order to limit these effects between the main technological options for reducing CO_2 emissions and implicitly CO_2 from the atmosphere, the appropriate use of agricultural land to provide sustainable products as argued by Andrei, J. V et al (2015). Political decisions such as the Council of Agriculture Ministers (2021) were also followed by measures to increase the limited quantities of ecosystems, compared to the general approach of the Council (progressive growth, starting at 22% in 2023 and reaching 25% in 2025), agreed issues of the European Commission (2021).

As an exception, the concept of sustainability was first introduced as a strategy to picture an example of a situation in the awareness of globalization and the increased result on it of the risk of loss of natural resources by intensifying the expansion activities of the industry. Considering the foreshadowing of a rising trend of agricultural productivity in development areas, the scenario of environmental impact with direct consequences on resources such as phosphorus, as a fertilizer raw material in agriculture, is inevitable. Thus a topic like resource depletion has a direct effect on the costs of phosphorus-based fertilizers. Fertilization with widely used phosphate has the advantage that phosphates have a much lower solubility, accumulating in the mineral fraction. Taking all these aspects into account, the key objective of the paper is to quantify the benefits of phosphorus in current agricultural practices at farm level. The case study on the simulation of phosphorus consumption was performed on maize production. In Romania, the fertilization of arable lands is practiced, especially with chemical fertilizers and there is a need more than ever to change the direction of agricultural methodologies depending on the effects of soil erosion. Ordinary agricultural practices are not adapted to the effects of climate change on small farms, because in the absence of widespread use of irrigation, the efficiency of agriculture in Romania is covered by dependence on climatic conditions, which is a stress factor for plants as claimed by Popescu et al. (2020).

Producers are concerned about measures to conserve natural flora and wildlife in the field of water, as well as pesticide residues in food and feed of plant and animal origin. As a result, pesticide use will be reduced, and human health and the environment will be protected from potential threats related to the use of pesticides by carrying out agricultural fertilization work in a timely manner may be a way to reduce the risks and their effects on human health and the environment (Ramírez, 2019).

Several measures, including, in particular, the use of antibiotics, should be used to prevent the occurrence and removal of hazardous organisms: crop rotation, the use of adequate cultivation techniques, why not an agricultural discipline related to production

efficiency. This could include the use of several pesticides with different modes of action. Our research's risk methodology reveals the prevalence of acts that have an impact on biodiversity and natural capital resilience. What we set out to do is to provide a diagram of the risks of an agricultural economy caused by the assimilation of sustainability in the context of the demands imposed by climate change, but also of their global consequences, the continuous loss of natural resources. From this vantage point, we've discussed why it's critical to prioritize the risks in the agricultural system when it comes to fertilizers. As a result, several factors such as climate change, low yields associated with low selling prices, and agricultural commerce, as asserted by Nicholson, F et al., are not factors that determine fertilizer consumption (Nicholson et al., 2020).

The resilience of agriculture achieved through the convergence of the sustainability component is conditioned by the process levers necessary for alignment with cross compliance so that it becomes efficient, the process being cyclical, as argued by Aznar-Sánchez, J. (2019).

The positive premises that foreshadow a large-scale symbiosis of the biosphere is a component of innovative research in various fields related to agriculture, the installation of new technologies being necessary to mitigate and adapt to climate change, and improve the quality of large-scale agriculture. Highlighting methodologies for farming does not necessarily follow a cliché, but a form of monitoring the minimum burden on biodiversity. But how do we potentiate the equation between reducing pollution, soil degradation and greenhouse gas emissions, maintaining biodiversity or whether constraints to maintain balance by improving soil fertility calls into question how much do we actually rely on fertilizers and how do we reduce consumption, what are the risks and returns (Johan F.M. Swinnen, 2015).

In recent decades, intensification practices in agriculture have contributed to increased yields. This has led to wide-ranging implications for shaping the ecological behavior of agricultural producers and achieving a more environmentally responsible agri-food model in the context of the CAP's greening policy (EC 2021).

Materials and methods

The statistical agricultural research inserted in the paper comes to evaluate the decarbonization potential of agriculture from another angle. Phosphorus is a necessary component of life. Phosphate mineral fertilizers have become the principal supply of phosphorus in world agricultural production, as well as the initial source of newly introduced phosphorus in the cycle, and there is no substitute for their usage in animal feed and fertilizers. The existing scenario, which includes waste and losses at every stage of the phosphorus life cycle, raises concerns about future phosphorus supply as well as water and soil contamination in the EU and around the world. The Brussels Advisory Communication on the Sustainable Usage of Phosphorus, CE (2013) 517, advises that measures be implemented to increase the efficiency of phosphorus use and recycling. Improvements in phosphorus consumption and recycling efficiency would

also have a number of additional advantages, such as better soil management, which would enhance climate and biodiversity. (European Commission, 2021)

It is known that agriculture is a primary consumer of natural resources, a major user of the world's land area, according Fanelli R.M. (2019), directly dedicated to its use, a net consumer of water and accounts for most of the ammonia emission (Fanelli, 2019). Evaluations regardind the sustainability of the farm have been amply highlighted in scientific research contains that in order to be so framed in the vision of Girardin, P., (2021) a farm should be habitable, transmissible and reproducible from an ecological point of view economic and social (Girardin, 2012).

At the same time, Lynch et al (2021) emphasizes the huge role that agriculture plays in climate mitigation, the connection with strategies and mitigation capacity are closely linked (Lynch, 2021).

Climate targets have gradually become more prominent in the CAP over the last two decades. This section describes how climate concerns have been integrated into the CAP over time. Climate action was not a stated priority for the CAP before 2007 (European Commission, 2014)

However, certain measures and instruments that have been implemented could have some effect on climate change mitigation. For example, with the introduction of decoupled direct payments in 2003, intensive production was less encouraged. Evaluation of carbon storage and land use strategies in functional and competitive market economies have become increasingly visible in the concerns of scientific research, thus making way for the new era of less polluting agricultural development with very ambitious agricultural decarbonisation targets in a percentage of 40% by 2030, these being modified with a target of 55% by 2050 (EC 2020).

Through phase 1, support in the agricultural system is conditioned by the unequivocal obligation imposed on farmers to manage agricultural land in a sustainable way. For the creation of storage conditions and sequestration of carbon in the soil between the obligations of good agricultural practices and environmental conditions (GAEC) are found and conditioning states to implement standards to reduce soil erosion and maintain organic matter levels and soil structure (Good agicultural and environmental conditions, 2021). Among the conditions of cross compliance, rules have also been introduced for the protection of permanent pastures, setting national limits for the percentage that could be plowed and thus generate CO_2 emissions. As indicated by the Agricultural Organization of the United Nations, there are visible foreshadowing of increasing consumption due to population growth forecasts without excluding the need for demand for food resources or problems over time of renewable resources. In fact, the major challenges facing the agricultural sector today are offset by the need to balance the relationship of insufficient natural resources and the interdependence between increasing productivity and climate change. Trends in consumption, trade and productivity from an agricultural perspective as well as prices in the coming years until 2030 will reach inevitable changes.

In this point, agriculture has to fulfill not only the ambitious depollution targets but also those of efficiency and sustainability in agriculture. The conclusion is that agriculture must become more efficient while improving agricultural productivity in order to reduce its impact on the environment.

Using high-quality plant protection solutions to acquire quality agricultural goods at affordable prices while posing minimal danger to human health and the environment is a crucial aspect in enhancing agricultural output and decreasing crop losses. As shown in Figure 1 at EU level, there is a significant share of agricultural products, imports being in real balance with exports but the concern is what has led to increased agricultural production on arable land used to increase the yield of agricultural production. This increase has often been attributed to high-yielding varieties, such as wheat or corn.

Figure 1. Tonnes (grain equivalent) import/export from 2017 to 2020 (in 1,000 euros)
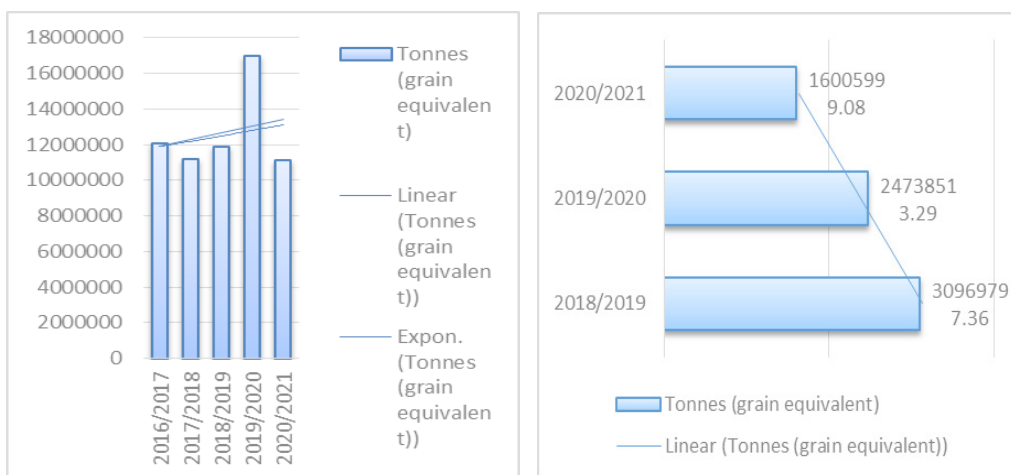
(**a**) Tonnes (grain equivalent) export (**b**) Tonnes (grain equivalent) import

Sources: Eurostat data (2020) Directorate General for Agriculture and Rural Development

However, in order to achieve their high yields, the new varieties required large amounts of chemical fertilizers and pesticides, raising concerns about costs and potential environmental harm.

The largest shares of land sown with maize and wheat, 44 percent and 31 percent of the total area under cereals, respectively, belonged to products that are on the one hand a resource for food security of exports to the population, feed, and training, and on the other hand a resource for food security of exports to the population, feed, and training.

The main quantitative methods considered in the impact assessment concerned the counterfactual assessment method. The method of counterfactual impact assessment applied at the level of micro-data specific to those instruments relevant to this field, aim to allow quantification of the extent to which a particular monitored indicator produces

effects and may aim to identify the direction of the link and the impact of reducing resources phosphorus-based fertilizers on yields in the case study chosen corn production. The method used is difference-in-differences (DID). (Constantin Anghelache et al, 2019)

Availability of the characteristics observed before the intervention takes place the advantage is that this method does not require the estimation of complex data structures, but only aggregated data. In order to apply the evaluation methodology counterfactual impact was necessary to collect specific micro-data at the level of statistical tools fertilizers including phosphorus used in maize production, maize production in the period established from 2011-2020, and other information such as the percentage of phosphorus used in estimated fertilization formula, determined on the basis of the fertilization formula with N. The data sources were administrative, it should also be noted that the estimates of the net impact of this assessment will not be aggregated globally, but regionally to maize production of Romania.

The counterfactual scenario required was the basis for assessing the estimated regression of phosphorus resources.

In fact, in collecting and analyzing the data, in order to carry out the case study we compiled qualitative and quantitative procedures related to the large production of maize. How the crops react to phosphate fertilizers is highlighted below. If the level of P available in the soil is not suitable for optimal crop growth, use phosphate fertilizers to ensure adequate amounts of this nutrient in the solution phase. Terminology and sources of phosphate fertilizer from the market. Understanding the terminology and dosage used can help increase yields. An example of calculation refers to a farm that has an agricultural area of only 0.4 ha cultivated with corn, which we indicated in a simulation of fertilizer consumption in this case phosphorus. In this case the maximum amount of nitrogen that can be applied if an agrochemical study is not performed.

As previously stated, phosphates are utilized in conjunction with other substances on a 0.4 ha corn-growing farm; in this situation, the maximum amount of nitrogen that can be applied is:

0.4 (ha of corn) x 130 Kg N / ha / year) = 52 kg N / year.

The simple superphosphate requirement is calculated taking into account the active substance concentration of 16 - 18% P_2O_5 or 46% triple superphosphate (P_2O_5). The percentage resulting from dividing N with phosphorus,

18,545 ÷ 5096 = 3,64% the percentage between N used and phosphorus was thus obtained 130 ÷ 3,64% = 35,72

0.4 (ha of corn) x 35,72 Kg P_2O_5 / ha / year) = 14,30 kg P_2O_5 / year.

If at 0.4 ha 14.30 kg P_2O_5 / year is used then at 1 ha 14.30 x 2.5 = 35.72 kg P_2O_5 / year is used the agricultural area used for maize production in Romania from 2007 to 2019. The land covered for maize production was the largest in 2012, with 2.73 million hectares and the smallest in 2010, with 2.1 million hectares.

Thus, it results as an approximate simulation that at 3 million hectares the phosphorus needs are very high of approximately 42.864 thousand kg / 1000 ha. 25% P_2O_5 Phosphorus expressed as P_2O_5 soluble in neutral ammonium citrate, in which at least 93% of the declared content of P_2O_5 is soluble in water.

The water solubility quality of phosphorus pentoxide entails the qualities of using mineral fertilizers (N and P) given these characteristics as follows Limiting the risks of groundwater pollution through the reduced mobility of phosphorus, properly dosed, which makes it possible, on sandy soils, very permeable, to allow the passage of fertilizer particles but without absorbing them; On the other hand, in the case of surface waters, the risk of phosphate pollution increases, given the erosive runoff processes that produce the transport and accumulation of phosphate-laden soil particles in surface waters.

In order to ensure a high agronomic yield, mineral fertilizers must be applied in addition to natural sources, the double effect also having the purpose of protecting the environment against chemical pollution such as nitrate pollution of water. That is why an increased share in weed control in vegetation is given by the stage of the plant for the application of fertilizer on crops, and because the role of fertilizer is to act on the bacterium nitrosomonas by keeping it inactive. By maintaining nitrogen (NH_4 +) in a stable form for longer, exposure to leachate and denitrification losses is limited. The aim is for the Nitrogen applied to the crop to remain for a long time at the level of the plants in order to increase the production potential. The optimal efficiency of fertilizer application is conditioned by the interaction of fertilizers without stress conditions.

Results

The transition to sustainable food systems, especially through the transition to organic farms, will bring new opportunities to farmers and operators throughout the food supply chain, generating both healthy food and lower environmental costs. EU regions that produce arable crops tend to stabilize phosphorus levels in the soil, but continue to depend on the application of phosphorus mineral fertilizers (Popescu L. et al., 2020).

Soil erosion and percolation, as well as ineffective manure, biodegradable waste, and wastewater, are all major sources of useful phosphorus loss. Water is used extensively in the extraction and processing of phosphate rocks as a raw material. As a result, while contemporary mines can reuse 95% of the water they take in, this is not the case in all cases because there are no ways for extracting phosphorus from these waters. Furthermore, there is a possibility of very acidic treatment water leakage or infiltration, particularly from basins atop phosphogypsum stacks, which might damage aquatic environments.

Water supply can be a significant limiting factor in the development of phosphate extraction because phosphate rock formations are commonly found in water-scarce areas. The extraction process consumes a lot of energy, which has a direct impact on the cost of production. The rise in phosphate rock prices is largely due to supply and demand, with one element being increased demand owing to biofuel crops.

They also reflect food costs and may be a modest contributor to rising food costs. In this regard, we underline that agricultural systems as a whole require careful consideration; for example, we mention the necessity for phosphorus (P) for plant advantages both during early phases of plant development and during maturation. Among the direct effects on plants by performing phosphorus fertilization is to ensure good root growth in immature plants, reduce the maturation period and thus improve the stress resistance of the plant. Also the presence of phosphorus is a necessary component for storage and supply of cell energy.

On the other hand, the lack or insufficiency of phosphorus (P) leads to a slowdown in the process of root growth, and the leaves turn purple in shades of purple. It delays flowering and ripening, and production and quality are affected. In order to ensure the efficient and economically viable protection of agricultural crops, plant protection products should be applied only when strictly necessary, when the conditions for the occurrence of harmful organisms are met.

Figure 2. Global fertilizer use for corn from 2011 to 2021 (in 1,000 metric tons)

Sources https://www.statista.com/statistics/201092/global-fertilizer-use-for-corn-from-2010/#statistic
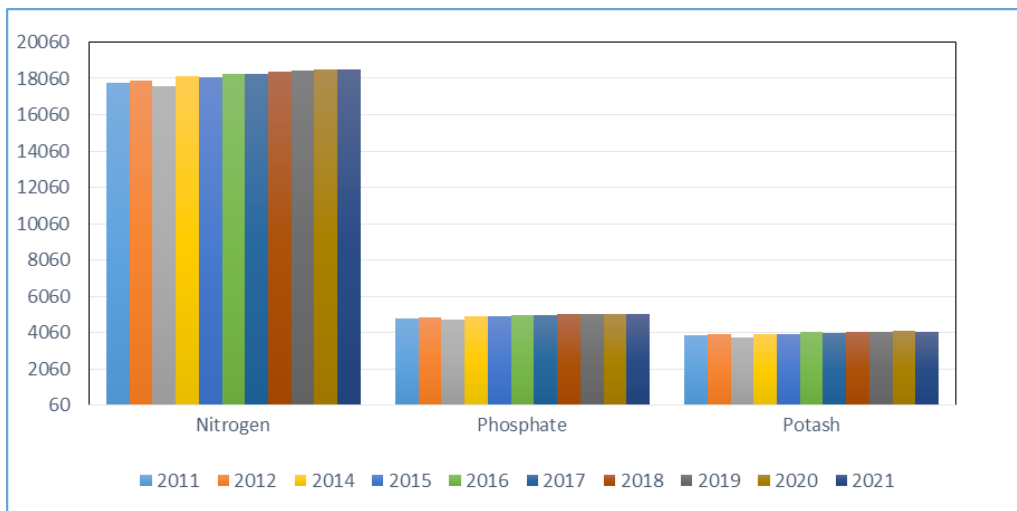
In the statistical example presented in Figure 2 is highlighted a projection on the global consumption of certain types of fertilizers for crops of corn nitrogen phosphate, potassium between 2011 and 2021. We conclude from the analysis that in 2018, it was expected o the global use of approximately 27.6 million metric tons of fertilizers in maize production. Also the Figure 3 (b) statistic presents the value of maize or corn exported from Romania annually from 2012 to 2020. Exports of maize were valued at approximately one billion euros in 2020 (Ramírez,2019).

Analyzing the information we notice a sudden rise in corn production which means not only the increase in the need for consumption but also the development of sales marketing on demand corn, the increases being due to high yielding varieties and appropriate fertilization.

Figure 3. Value of maize or corn exported from Romania from 2012 to 2020 (in 1,000 euros)
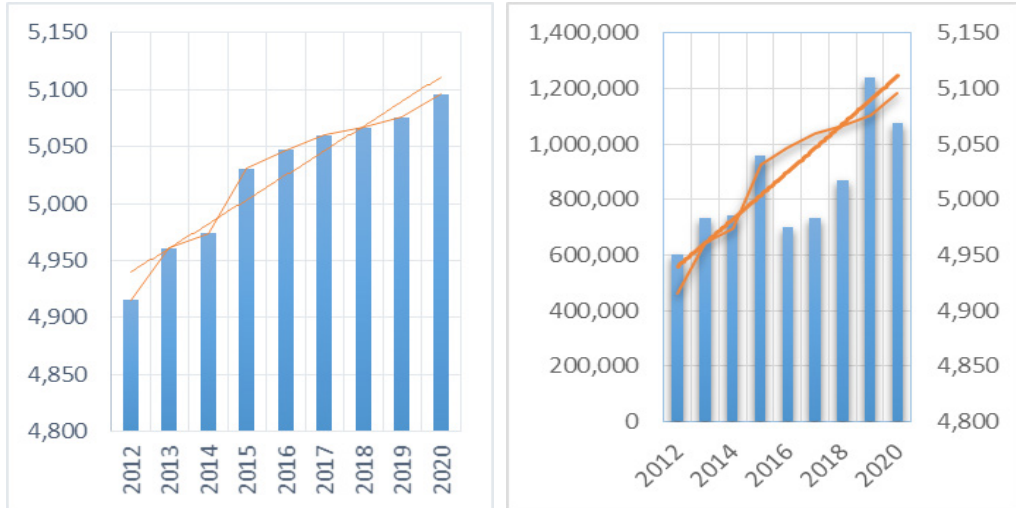
(**a**) phosphate fertilizer use for corn from 2011 to 2021

(**b**) Value of maize or corn exported from Romania from 2012 to 2020

Sources: own analysis

This statistic illustrates projections for the worldwide use of fertilizers from 2011 to 2021, for corn. For the year 2018, a global fertilizer use of approximately 27.6 million metric tons is projected for corn. Also the Figure 3 (a, b) statistic presents the value of maize or corn exported from Romania annually from 2012 to 2020. Exports of maize were valued at approximately one billion euros in 2020.

Because phosphorus cannot exist alone in nature and forms compounds of apatite (Ca_5 (PO_4) 3F) and phosphorite ($Ca3$ (PO_4) 2), the transition to a mode of use in agricultural production as fertilizer necessitates a combination of elements highlighted in Table 1. At the same time, phosphorus must be used in accordance with the other nutrients required by plants.

Nitrogen fertilizers have a high solubility and have the quality of providing almost all the nutrients needed by plants in a form that allows their direct and easy absorption. Table 1 shows Simple phosphate fertilizers highlighting the nutrient content; the forms and solubilities of nutrients;

Table 1. Simple phosphate fertilizers

Title	Data - method of obtaining components		Nutrient content; the forms and solubilities of nutrients;
Partially solubilized phosphate rock (active phosphori)	Product obtained by partial solubilization of ground phosphate rock with sulfuric or phosphoric acid, containing as main component monocalcium phosphate, tricalcium phosphate and calcium sulphate	20% P_2O_5 Phosphorus expressed as soluble P_2O_5 in mineral acids, of which at least 40% of the declared content is soluble in water. Particle size: - at least 98% of the product must pass through the meshes of a 0,630 mm sieve	Total phosphorus pentoxide (soluble in mineral acids). Water-soluble phosphorus pentoxide.
Ground phosphate rock	Product obtained by grinding phosphate rock, which contains as main components tricalcium phosphate and calcium carbonate	25% P_2O_5 Phosphorus expressed as mineral acid soluble P_2O_5, of which at least 55% of the declared P_2O_5 content	Total phosphorus pentoxide (soluble in mineral acids) is soluble in 2% formic acid. The mass percentage corresponding to the material passing through a 0.063 mm sieve

Source: MADR - Annex Decision on establishing the conditions for placing on the market chemical fertilizers from domestic production and imports

Thomas slag, calcined phosphates, and calcium and aluminum phosphate must not be present in an NPK fertilizer comprising pulverized or partially solubilized phosphate rock. It has to be declared based on the solubility. Phosphorus mineral fertilizers have a much lower solubility than potassium mineral fertilizers (10-20% in the first year after application for phosphorus and 30-40% for potassium), accumulating in the colloidal mineral formations of the soil before being blocked under in the form of calcium, sparingly soluble magnesium phosphates.

Figure 3 depicts phosphorus deficit in a maize crop. Phosphates have a far lower solubility, thus they accumulate in the soil's colloidal mineral fraction, where they are reversibly adsorbed. Phosphorus fertilizers are chemicals that contain phosphorus in the form of anions: mono-, di- or triphosphate. The expression, according to international norms, is done in percent of phosphorus pentoxide (P_2O_5). Nitrophosphates are complex fertilizers that are obtained by attacking phosphate rock with nitric acid. Several NP or NPK types can be obtained by this process. The most used are: K-22-22-0, K-23-23-0, K-27-13.5-0, K-22-11-11 and K-16-16-16. They contain up to 70% water-soluble P_2O_5 relative to the total content. It is generally applied to basic fertilizers.

Discussions

In line with the objective of the current paper, a statistical analysis was performed to materialize the key problems of agricultural systems to climate change and to explore the implications of fertilization techniques, highlighting the depletion over time of phosphorus resources so used in production agricultural.

The data and information presented were collected from open access resources on official EU websites and from scientific papers on the subject. The availability of data is meant to provide transparency in the efforts of Eurostat and the OECD as well as the EU, on issues of Agricultural Policy.

The first effect of the CAP, characterized by increased flexibility, created the possibility for Member States to design their own individual program adapted to rural development for 2014-2020 in accordance with EU regulations no. 1303, 1305 and 1306/2013 (E.P., 2020).

The necessary changes to synthesize the data visualization consist in the mathematical mediation, where appropriate, to represent the annual numbers for the analyzed period 2015 - 2019 respectively, in some cases, were expressed at import-export rates to agricultural production of cereals in which it is mandatory, from the perspective of analyzing resources such as phosphorus (Report, 2020, European Commission; World fertilizer trends and outlook to 2022).

Conclusions

These permanent monitoring by the scientific elite as well as by the EU authorities in linking the transition to decarbonization of agriculture have the effect of monitoring the economic vulnerability of farms (Volkov et al., 2019).

Agriculture and horticulture pose a threat to lakes and rivers by polluting them. Mineral fertilizers, it can be stated, have an impact on regional imbalances in this context. Phosphorus fertilizer, unlike nitrogen fertilizer, is derived from rock phosphate and cannot be chemically produced. The shortage of phosphorus may result in a rise in market price as a result of its economic impact. Production may be reduced as the price of phosphorus rises, and competitive consumers may notice the impacts. Farmers' costs are growing due to increased market prices, which has an economic consequence. When there is a lot of demand, the majority of the immigrant workers will be able to find work.

Phosphorus is a valuable commodity that is commonly used in agriculture. As a result, after the emergence of extremely high phosphorus consumption, consumers faced higher expenses, farmers faced higher costs, and farmers faced higher revenues. The amount of phosphate in the soil that has been water-solubilized is mostly absorbed by plant roots; the amount induced by water movement in the deeper layers of the soil is relatively modest. Phosphorus improves plant health, benefits the environment by reducing leaching and reducing the amount of nitrates in groundwater and has the role of reducing the emission of harmful greenhouse gases into the atmosphere. For example: fertilizers in which P_2O_5 predominates are more suitable for straw cereals before sowing, those with a nitrogen ratio are suitable for technical crops, etc. The properties of the soil influence the use of fertilizers, irrigation and fertilization can be combined, obtaining a simultaneous supply of water and nutrients.

A possible regression of pesticide use without excessive decrease in yields pursued by sys-temic forecasts can be achieved even without reversing the decrease in production poten-tial and production losses by cyclically monitoring yield control, exploring and improving

more disease-tolerant varieties. The effects of such an investigation bring to the fore not only the recovery of yields through improved varieties but the use of a necessary consumption of phosphorus-based fertilizers adapted to climate practices, to better capitalize on the potential of resources used as mineral fertilizers such as phosphorus or an indispensable resource in world agricultural production. As we can see, there are many CAP measures that are used in order to contribute to climate change activities through green payments under the CAP conditions imposed on farmers through cross compliance, as well as voluntary measures under rural development policy. The question is whether climate change because farmers are more than an awareness of the depletion of natural resources with the concern to provide sustainable and healthy production for export, and why not to reduce grain imports.

The paper also identifies that the CAP is accountable to farmers for cross-compliance obligations and good agricultural practices in relation to the EU's agricultural capacity, especially with regard to other effects of climate change, and from this angle the reduction of resources such as phosphorus is a concern. However, from a climate change perspective, it should be a mandatory approach for all assets agricultural authorities.

The current CAP will set targets for how EU agricultural systems are able to meet the prevailing challenges, especially those related to climate change. The key issue of the future policy is the ability of the farmer to mitigate the environmental compromise through sustainable practices and constant adaptation (Wieliczko, 2019). Agriculture requires a repositioning towards the other actors of the economy to behavioral changes in the responsibility of farmers' actions in accordance with the appropriate environmental requirements. Economic performance has consequences for innovation decisions, shaping production structure and causing structural change, but when it comes to depleting the resources used in agriculture the first option is the systemic use of these products such as phosphate (DeBoe et al., 2020).

Conflict of interests

The authors declare no conflict of interest.

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FINANCIAL ASPECTS OF PEPPER (*Capsicum annuum L*) PRODUCTION ON FAMILY FARMS IN SERBIA

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ARTICLE INFO	ABSTRACT
	In the structure of agricultural production in the Republic of Serbia, crop production is dominant, while the share of vegetables in crop production is small (about 3.5%). According to the research conducted by the Institute for the Application of Science in Agriculture during 2015-2019, one of the most profitable vegetable production is pepper production. The aim of this paper is to investigate the financial aspects of pepper (*Capsicum annuum L*) production as one of the most common vegetable crop in the Republic of Serbia, and to assess its economic viability. The following methods were used: survey, comparison, desk research, gross margin calculation and sensitivity analysis. Sensitivity analysis showed that in addition to the yield, the price also has a great influence on the amount of the gross margin. The price risk would be reduced if there were "contracted agricultural production", which would improve the profitability and sustainability of pepper production. © 2021 EA. All rights reserved.

Introduction

Agriculture is one of the most important economic activities in the Republic of Serbia, which is confirmed by the fact that the share of gross domestic product (GDP) of agriculture amounts to 7.4% of the total GDP, and the share of employees in agriculture amounts to 15.6% of the total number of employees in the economy. Vegetable production in the Republic of Serbia is conducted on about 130,000 hectares, and the key carriers of agricultural production are family farms. Small farms are dominant, with an average of 5.5 hectares of land, which is significantly smaller when compared

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to farms in the EU. The vegetable production is a highly intensive and profitable branch of agricultural production, so it can have a significant impact on development of agricultural sector, but this production also significantly depends on the level of overall economic development. Vegetable production requires much labor engagement. The results show that producing one ton of peppers requires about 28 hours of human labor and 3.65 machine hours (Peševski et al., 2016). Vegetable production enables intensive use of land and irrigation systems, and it is possible to change two to three types of vegetables during the year. The specificity of a large number of vegetable species enables the production of food even in unfavorable climatic conditions, with the use of indoor production systems (greenhouses, hothouses).

The subject of this paper is an analysis of pepper production, as one of the most common vegetable crops in the Republic of Serbia, and the presentation of the financial aspects of this production on Serbian farms. The aim of the research is to look at the profitability of pepper production based on the analysis of data, as well as to consider current issues important for the sustainability of production.

Materials and Methods

For the purpose of this paper, there have been analyzed the data collected by the Institute for Science Application in Agriculture (ISAA) on gross margins in pepper production on family farms where this vegetable crop is most represented and where it this production is dominant. The number of collected and analyzed data on gross margins in the period 2015-2019 is presented in *Table 1*.

Table 1. Collected gross margin data from the family farms producing paper in Serbia for the period 2015-2019

Years	2015	2016	2017	2018	2019
Numbers	41	43	51	39	44

Source: ISAA Survey

The analysis of areas and production of the pepper was made based on the official statistical data published by the Statistical Office of the Republic of Serbia, as well as on relevant domestic publications and Internet sources. Gross margin analysis was made by using the data from a survey carried out by the Institute for Science Application in Agriculture. Comparisons of individual parameters were performed between two regions, Serbia North (includes the region of Vojvodina and the Belgrade region) and Serbia South (includes the region of Southern and Eastern Serbia and the region of Šumadija and Western Serbia) in accordance with the methodology applied by the Statistical Office of the Republic of Serbia. The data on gross margins in vegetable production were obtained from the survey conducted by the Agricultural Advisory and Expert Services of the Republic of Serbia, whose work is controlled by the Institute for Science Application in Agriculture, an organization authorized for the implementation of the Annual Program for the Development of Agricultural Advisory Affairs since

1990. Using the collected data on gross margins, the economic and financial aspects of vegetable production on selected family farms were monitored and analyzed in order to improve the profitability of farms.

Results and Discussion

The Republic of Serbia is a well-known producer of pepper, especially of industrial varieties, and in 2019 the area under pepper was at the level of about 10,000 hectares, mainly in the open field, with an average yield of about 11.7 t/ha, while indoor areas were rather negligible. Outdoor production is characterized by significantly lower costs of production, compared to the production in greenhouses and hothouses (Seepersad et al., 2013). In Serbia, pepper is grown in almost all parts of the country, and the most famous varieties are *Leskovac red pepper*, used fresh, but also for processing into *ajvar* and *ground-ale pepper*, and *Somborska babura*, used for pickling and preparation of traditional dishes (Maksimović 2004). Factors such as food safety, the paradigm shift from producer-driven value chains to demand-driven value chains, the globalization of supply chains, and the intensification of quality-based competition have, among other things, led to significant changes in vegetables export value chains (Gachukia, 2016).

Table 2. Areas under pepper in the Republic of Serbia and the regions of Serbia North and Serbia South for the period 2015-2019

Regions	Republic of Serbia			Serbia North			Serbia South		
Year	Land area (in ha)	FBIN* (%)	CBIN** (%)	Land area (in ha)	FBIN* (%)	CBIN** (%)	Land area (in ha)	FBIN* (%)	CBIN** (%)
2015	14,845	100.00	100.00	3,471	100.00	100.00	11,374	100.00	100.00
2016	16,977	114.36	114.36	4,229	121.84	121.84	12,748	112.08	112.08
2017	17,386	117.12	102.41	4,371	125.93	103.36	13,015	114.43	102.09
2018	12,016	80.94	69.11	2,014	58.02	46.08	10,002	87.94	76.85
2019	10,097	68.02	84.03	1,323	38.12	65.69	8,774	77.14	87.72

Fixed base index numbers

***Chain base index numbers*

Source: Authors' calculation based on data collected from the ISAA survey on selected family farms

Data on the variation of areas under pepper in the Republic of Serbia and the regions of Serbia North and Serbia South for the 2015-2019 period are shown in *Table 2*. Looking at the regions of Serbia North and Serbia South, almost 90% of the total area under pepper is located in the region of Serbia South. Based on the presented data, it can be seen that the areas under pepper were largest in 2017, when they amounted to 17,386 hectares, while they were lowest in 2019, when they amounted to 10,097 hectares. The highest growth of areas, as shown by the indicator calculated by the base index, was recorded in 2016, when the areas under pepper were 14.36% higher compared to 2015.

In the same year (2016) there was the largest increase in the area under pepper when observed by particular regions (Serbia North and Serbia South), but slightly higher growth was recorded in the region of Serbia North and it amounted to 21.84%, while in the region of Serbia South it amounted to 12.08%. In 2019, the area under pepper was 31.98% smaller compared to 2015. The smallest areas under pepper were recorded in 2019 (about 7,000 hectares), which is a significant decrease of about 45% in comparison with the one in 2017. Looking at the particular regions of Serbia North and Serbia South, it can be concluded that the situation is similar in those regions to the territory of the whole country, with a significantly higher reduction of areas under pepper in the region of Serbia North. The indicator obtained by the calculation of base indices shows a decrease in the area under pepper. In 2019 there was a decrease of 61.88% for the Serbia North region and 32.86% for the region of Serbia South, when compared to 2015. The obtained volume of pepper production mainly follows the areas on which pepper is grown, so lower yields were achieved in the years when smaller areas under these vegetables were exploited. The largest production was achieved in 2016, although the areas under pepper that year were somewhat smaller than in 2017. Based on the presentation, it can also be concluded that the yields of pepper, when observing the regions of Serbia North and Serbia South, are proportional to the areas where pepper is present, from which it can be concluded that the average yields in some years are similar.

Table 3. Pepper production in the Republic of Serbia, regions of Serbia North and Serbia South for the 2015-2019 period

Region	Republic of Serbia			Serbia-North			Serbia-South		
Year	Yield (t)	FBIN (%)	CBIN (%)	Yield (t)	FBIN (%)	CBIN (%)	Yield (t)	FBIN (%)	CBIN (%)
2015	165,195	100.00	100.00	44,130	100.00	100.00	121,065	100.00	100.00
2016	227,645	137.80	137.80	61,921	140.31	140.31	165,724	136.89	136.89
2017	198,583	120.21	87.23	57,007	129.18	92.06	141,576	116.94	85.43
2018	135,072	81.77	68.02	25,586	57.98	44.88	109,486	90.44	77.33
2019	118,256	71.59	87.55	17,257	39.10	67.45	100,999	83.43	92.25

Source: Authors' calculation based on data collected from the ISAA survey on selected family farms

Table 3 shows the total production of pepper during the analyzed period both for the Republic of Serbia and for the particular regions of Serbia North and Serbia South. The maximum production for the whole country was 227,645 tons in 2016, and the lowest production was in 2019 and amounted to 118,256 tons. Based on the calculated indicators of the base index, it can be concluded that the highest total production was achieved in 2016, when it was 37.80% higher than in 2015. The growth of production in relation to the base year was achieved in 2017, as well, when the production was 20.21% higher. In the next two years (2018 and 2019), there was a decline in total production. In 2018 the

production decreased by 18.13%, while in 2019, 28.41% less pepper was produced than in 2015. This trend of decreasing production volume can be explained by a relatively short shelf life of the product (fresh vegetables). Storage and canning is also challenging, especially for small farmerspe who often do not have the capacity necessary for further processing and transport to remote markets (Zečević et al., 2019).

Looking at the regions of Serbia North and Serbia South separately, the trend of increasing production is similar; in 2016 the increase was about 40%, while in 2017 there was a slightly larger increase in the region of Serbia North. In the next two years (2018 and 2019), there was a decrease in production, more pronounced in the region of Serbia North, where in 2018 production was 22.02% lower, and in 2019 it was 60.90% lower. The indicators obtained by calculating the chain indices show changes in the produced quantities when compared to the previous year. Based on these indicators, it can be concluded that, when compared to the previous year, the growth of production was recorded only in 2016 (37.80% growth), while in the following years there was a decline, because the highest pepper production was achieved in 2016. Looking at the regions of Serbia North and Serbia South, the obtained indicators are similar to the ones for the entire country, with larger reductions from year to year in the region of Serbia North.

Financial aspects of pepper production on farms in the Republic of Serbia

Some authors suggest the use of different methodologies for the purpose of determining the efficiency of the resource used. This should help farmers to observe the degree of sustainability of their activity, save money and improve their competitiveness (Elzaki et al., 2019). As one of the indicators for the stated needs, it is possible to use the calculation of gross margin. Gross margin is determined as the difference between the selling price per unit of product and variable costs per unit of product and it is the first indicator of profit potential, i.e. it indicates the contribution of each unit of product to the covering of the fixed costs and obtaining the gross profit. The gross margin is also used to determine the break-even point, to optimize the product range, to decide on the introduction of new product or eliminate the existing products (Weygandt et al., 2018). In addition, the gross margin is used as the first indicator of business risk, which allows farmers to take appropriate actions to minimize the loss.

According to the FADN methodology, two approaches are possible when calculating the gross margin at the level of farm. The first combines the value of production and total variable costs, and according to the second one, gross margin is determined as the difference between the value of products sold externally and variable costs that lead to an outflow of funds (Ivanović et al., 2018). For the purposes of this paper, the gross margins was calculated according to the first approach.

Total variable costs in pepper production include costs arising from: land preparation, procurement of seeds and seedlings, weed control, fertilization, irrigation, pesticides and disease treatment, harvesting, salaries of permanent and seasonal labor force. In addition to the above, they also include components such as interest on working capital, crop insurance costs and others (Takele 2001; Gogić 2014).

The average annual amounts of production value, variable costs and gross margin in the production of pepper on family farms in the Republic of Serbia were calculated on the basis of direct costing calculation (calculations based on variable costs) for the analyzed period 2015-2019. Variability of the stated financial indicators for the period 2015-2019 calculated per 1 hectare, is shown in Figure 1.

Figure 1. Variation of financial indicators for pepper production in the period 2015-2019 (calculation for 1 hectare)
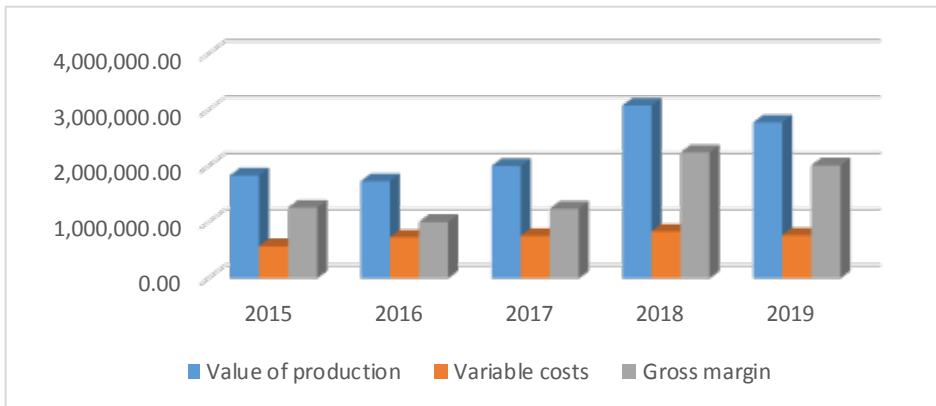
Source: Authors' calculation based on data collected from the ISAA survey on selected family farms

Based on the Figure 1, it can be seen that the largest amounts of all financial indicators were recorded in 2018. The lowest production value and gross margin were recorded in 2016, while the lowest variable costs were recorded in 2015.

Table 4. Financial indicators of pepper production for the 2015-2019 period (calculation for 1 hectare)

Year	2015	2016	2017	2018	2019
Production value (RSD)	1,833,560.00	1,732,450.00	2,000,702.70	3,079,949.55	2,779,809.41
FBIN (%)	100.00	94.49	109.12	167.98	151.61
CBIN (%)	100.00	94.49	115.48	153.94	90.26
Variable costs (RSD)	572,526.79	729,869.32	759,711.20	835,756.77	767,564.44
FBIN (%)	100.00	127.48	132.69	145.98	134.07
CBIN (%)	100.00	127.48	104.09	110.01	91.84
Gross margin (RSD)	1,261,033.21	1,002,580.68	1,240,991.50	2,244,192.78	2,012,244.97
FBIN (%)	100.00	79.50	98.41	177.96	159.57
CBIN (%)	100.00	79.50	123.78	180.84	89.66
Share of gross margin in production value (%)	68.78	57.87	62.03	72.86	72.39

Source: Authors' calculation based on data collected from the ISAA survey on selected family farms

Table 4 shows the most significant financial indicators calculated based on variable costs in pepper production for the period 2015-2019 (calculated for 1 hectare). The value of pepper production in 2015 amounted to 1,833,560.00 dinars/ha, while in the following year it decreased, which is also the lowest amount in the analyzed period (1,732,450.00 dinars/ha). During the next three years, the value of production increased. In 2017, the value of production amounted to 2,000,702.70 dinars/ha, and in 2018, when the largest amount was recorded (3,079,949.55 dinars/ha). In 2019, there is a slight decrease in the amount of production value (2,779,809.41 dinars/ha).

Observing the indicators calculated on the basis of base indices, it can be concluded that only in 2016 there was a decrease of 5.51% in the value of pepper production, compared to the base year (2015), while in other analyzed years there was an increase. In 2017, the increase in the value of production amounted to 9.12%, and in 2018 as much as 67.98%, compared to the base year. In the last analyzed year, the increase in the value of pepper production was 51.61%, compared to the base year. Indicators obtained on the basis of chain indices show that in 2017, compared to 2016, there was an increase of 15.48% in the value of production. In 2018, the value of production was 53.94% higher compared to 2017, while in 2019 the value of production decreased by 9.74%, compared to 2018.

Production costs are determined by the quality of the used inputs and their prices. The coefficient of cost-effectiveness (obtained as the ratio between the value of production and production costs) indicates the degree to which resources are rationally used (Pavlović et al., 2010). Variable costs in pepper production recorded a continuous growth in some of the analyzed years, except in 2019, when they were slightly lower compared to the previous year. In 2015, the lowest variable costs of pepper production were recorded, amounting to 572,526.79 dinars/ha, while the highest were in 2018, amounting to 835,756.77 dinars/ha. The base and chain indices show that in 2016 the variable costs were 27.48% higher compared to the base year, while in 2017 there was an increase in variable costs compared to the base year by 32.69%, and in comparison to the previous year by 4.09%. In 2018, when the variable costs were the highest, they increased by 45.98% compared to the base 2015 year, and compared to 2017 by 10.01%. In 2019, variable costs were 34.07% higher compared to the base year, but there was a decrease in the amount of variable costs by 8.16% compared to 2018.

The increase in the value of pepper production, which also affected the increase in the gross margin, was primarily due to the growth of market prices of pepper in 2018 and 2019, while the average yield of pepper was at a similar level as in the previous period. The growth of the market price was certainly significantly influenced by the reduction of areas on which pepper was grown in 2018 and 2019 (data shown in *Table 2*), which resulted in decline of total pepper production (data shown in *Table 3*). Since there was a smaller amount of pepper on the market compared to the previous period, this greatly influenced the increase in its market price.

Due to the impact of variable costs on the amount of gross margin in pepper production, it is necessary to determine and analyze the structure of variable costs and see which costs have the largest share in this structure.

Figure 2. Structure of average variable costs in pepper production for the 2015-2019 period
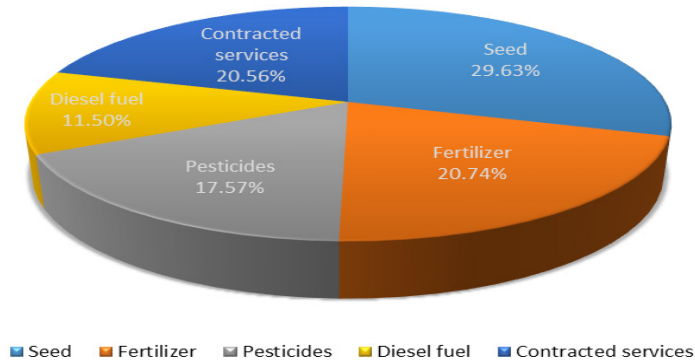
Based on the presented structure of average variable costs in pepper production (*Table 2*), it can be concluded that seed costs (29.63%) and fertilizer costs (20.74) have a dominant share. The costs of contracted services have a slightly smaller share, which makes up 20.56% of the total variable costs in the production of pepper. They are followed by pesticide costs with 17.57% and diesel fuel costs with 11.50%.

The gross margin in the production of pepper was highest in 2018, when it amounted to 2,244,192.78 dinars/ha, while a slightly lower result was achieved in 2019. In other years, the gross margin was lower, while the lowest amount was recorded in 2016, when it amounted to 1,002,580.68 dinars/ha. The indicators obtained from the calculation of base indices show that the gross margin in pepper production varied over the years. In 2016, the gross margin was 20.50% lower compared to the base year, while in 2017 it was slightly lower compared to 2015 (by 1.59%). In the remaining two observed years, the gross margin of pepper was higher compared to the base year (2015), in 2018 by 77.96% and in 2019 by 59.57%. The indicators obtained from the calculation of chain indices indicate variations in the amount of gross margins between the analyzed years. In 2016, the gross margin was 20.50% lower compared to 2015, and in 2017 it was 23.78% higher compared to 2016. In 2018, the growth trend of the gross margin continued and then there was an increase of 80.84% compared to the previous year. In 2019, the gross margin decreased by 10.34% compared to the previous year.

The obtained financial indicators of pepper production on farms in the Republic of Serbia in the 2015-2019 period show that the largest share of gross margin in the value of production was in 2018 (when the largest amount of gross margin was recorded) and

it amounted to 72.86%. A similar result was recorded in 2019, while in other years the share of gross margin in the value of production was somewhat lower, at the level of about 60%.

There is an opinion that the gross margin is an important indicator that the company (farm) creates in relation to competitors (Engle, 2013). For the purposes of assessing economic efficiency, it is important to compare the gross margin with a similar farms, taking into account whether it is production in the open field or in greenhouses, or whether it is a conventional method of production, or it is an organic production (Lampkin et al., 2001).

The previous analysis indicates that the selling price of pepper had a dominant influence on the value of production, and thus on the amount of gross margin, and it ranged from 49.41 to 66.23 dinars/kg. The lowest price of pepper was recorded in 2017, while the highest price was recorded in 2018. If we take into account the indicators that show significant changes in the value of production and gross margin between 2017 and 2018, it can be concluded that the price had a great impact on the changes. In 2015 and 2016, the price of pepper was around 51 dinars/kg, and in 2019 it was 63.65 dinars/kg.

Sensitivity analysis of gross margin in pepper production according to the changes in price and yield level

Sensitivity analysis of gross margin in pepper production according to the changes in prices and yields for the 2015-2019 period on the basis of a five-year price average, yields and gross margins achieved on the surveyed farms is shown in *Table 5*.

Table 5. Sensitivity analysis of gross margin in pepper production according to changes in prices and yields

Yield (kg/ha)		Price (RSD/kg)				
		-20%	-10%	Average	+10%	+20%
		44.98	50.60	56.22	61.84	67.46
-20%	30,049.33	791,990,68	960,928,00	1,129,865.32	1,298,802.65	1,467,739.97
-10%	33,805.49	960,928,00	1,150,982.49	1,341,036.98	1,531,091.46	1,721,145.95
Average	37,561.66	1,129,865.32	1,341,036.98	**1,552,208.63**	1,763,380.28	1,974,551.94
+10%	41,317.83	1,298,802.65	1,531,091.46	1,763,380.28	1,995,669.10	2,227,957.92
+20%	45,073.99	1,467,739.97	1,721,145.95	1,974,551.94	2,227,957.92	2,481,363.90

Source: Authors' calculation based on data collected from the ISAA survey on selected family farms

Based on the collected survey data on gross margins on farms where pepper is the dominant crop in the period 2015-2019, the average price, average yield and average gross margin in pepper production were calculated. The average price of pepper for the mentioned five-year period was 56.22 dinars/kg, the average yield was 37,561.66

kg/ha, while the average gross margin was 1,552,208.63 dinars/ha. Based on the sensitivity analysis of the gross margin in pepper production, it can be concluded that when reducing the price and yield of peppers by 20%, the amount of gross margin in pepper production is reduced by about 50%, while increasing the price and yield by 20% would lead to an increase in gross margin by almost 60%. Changes in the price and yield of peppers have the significant impact on the amount of gross margin in pepper production.

It is interesting to note that the price of pepper has significant oscillations in the past 15 years and that the price ranged from 188.3 EUR/t (2006) to 447.8 EUR/t (2017). Based on the model used by a group of authors (Mihajlović et al., 2019) for the purpose of forecasting the price of pepper for the period of five years (2018-2022) it is expected that the selling price of pepper will continue to grow and in 2022 it will amount to 530.8 EUR/t. This is important information for business planning purposes in the coming period. Additionally, the price of pepper varies between seasons, as well as between years. Seasonal variations can be explained by the influence of weather conditions, the occurrence of diseases and pests, while variations in prices between years can be explained by variations in areas sown and yields obtained, as well as due to climatic factors (Kelley and Boyhan, 2009). Starting from the stated point of view, the profitability of pepper production is determined by the quality and quantity of pepper produced, as well as their selling prices (Russo & Vincent, 2012).

Sensitivity analysis of gross margin in pepper production according to the changes in the amount of variable costs

Table 6 shows the analysis of the gross margin sensitivity in pepper production according to changes in costs that have the largest share in the structure of variable costs. Based on the collected data, it was determined that the share of seed costs makes up around 29.63%, while fertilizer costs make up 20.74% of the total variable costs. In third place according there are the costs of contracted services, which participate by 20.56%.

Table 6. Sensitivity analysis of gross margin in pepper production according to the changes in seed and fertilizer costs

Fertilizer costs (RSD/ha)		Seed costs (RSD/ha)				
		-20%	-10%	Average	+10%	+20%
		171,056.39	**192,438.44**	**213,820.49**	**235,202.54**	**256,584.59**
-20%	**119,759.28**	1,624,912.55	1,603,530.50	1,582,148.45	1,560,766.40	1,539,384.35
-10%	**134,729.19**	1,609,942.64	1,588,560.59	1,567,178.54	1,545,796.49	1,524,414.44
Average	**149,699.10**	1,594,972.73	1,573,590.68	**1,552,208.63**	1,530,826.58	1,509,444.53
+10%	**164,669.01**	1,580,002.82	1,558,620.77	1,537,238.72	1,515,856.67	1,494,474.62
+20%	**179,638.92**	1,565,032.91	1,543,650.86	1,522,268.81	1,500,886.76	1,479,504.71

Source: Authors' calculation based on data collected from the ISAA survey on selected family farms

Based on the collected survey data of gross margins on farms where pepper is the dominant crop in the 2015-2019 period, the average variable costs were calculated. The largest share in the variable costs' structure have the costs of seeds and fertilizer. Average costs of pepper seeds for the analyzed 2015-2019 period amounted to 213,820.49 dinars/ha, while the average costs of fertilizers amounted to 149,699.10 dinars/ha. When the costs of seeds and fertilizers are reduced or increased by 20%, the gross margin in the production of pepper increases or decreases by about 5%. Based on the analysis, it can be concluded that the changes in the amount of costs that have the largest share in the structure of variable costs (in this case the costs of seeds and fertilizers), do not have a significant impact on changes in gross margin in pepper production.

Economic sustainability of pepper production in the Republic of Serbia

Competitiveness can be viewed from at least two points of view: how successful the entity is in relation to other farmers (expressed through profitability, market share) and secondly the ability to offer products of appropriate quality at a lower price, or higher quality at the same selling price as competitors, which assumes lower production costs, the application of modern technology and higher productivity (Ion et al., 2019).

Having in mind the fact that family farms appear as the key actors of agricultural production in the Republic of Serbia, the question of their competitiveness can be quite justifiably raised. Namely, the average age of household members is extremely unfavorable in order to cope with the challenges that the wave of changes at the global level brings. The key challenges are reflected not only in intensive climate changes, which undoubtedly affect the quality and quantity of pepper production, especially due to the fact that in Serbia it is mostly carried out outdoors, but also due to unfavorable economic trends, regulatory changes, globalization of supply chain operations, changes in quality standards and the emergence of modern technology (Bodiroga et al., 2018). Additionally, the technology of production, processing and sale of agricultural products has changed (Repar et al, 2018). In modern business conditions, entire supply chains compete with each other (Savić et al., 2016). A horizontal link in the supply chain means that small farmers can work with commercial pepper producers. Vertical connectivity implies that different participants cooperate with each other, thus providing a benefit in the form of skills transfer from one participant to another, which consequently reduces transaction costs (Makoka et al., 2010). Relationships and conflict avoidance relationships can contribute to maintaining and improving product quality, increasing sales volume and reducing production costs, while maintaining market share (Belaya et al., 2016). However, for economic success, it is not enough just to produce a quantity of products of a certain quality, but the conditions under which the placement of these products is carried out are also of key importance. Research shows that reducing the costs of sales in the agricultural sector is closely related to an increase of productivity (Staboulis et al., 2019).

Although the projections indicate that a growing trend in the selling price of pepper can be expected in the upcoming period, the experiences so far remind us that surprises are quite possible. In addition, the question is open how much farmers benefit from high market

prices in retail and whether they will be ready to continue with the given production in the future due to all the described risks? Due to the pronounced volatility of sales prices, one of the ways to protect farmers from price risks is contracting (contract farming), i.e. concluding contracts with customers, which will specify the quantity, quality and selling price of the product. The results of previous research indicate that in this way it is possible to ensure vertical integration in the supply chain and at the same time to reduce transaction costs and strengthen the economic status of farmers (Harish 2019).

Conclusion

The paper discusses the trends of areas sown under pepper on the territory of the Republic of Serbia with the aim of assessing the sustainability of this production through the prism of economic indicators, given its significant contribution to exports and total GDP. The observed negative tendencies, such as the pronounced oscillation of production costs and sales prices, significantly complicate the production planning and open a number of existential issues that farmers face with.

The fact that farmers represent one of the segments in the agri-food supply chain, provides them with the opportunity to improve their position through cooperative relations with other participants. In reality, it is not uncommon for production costs and product sales prices to move in the opposite direction, which affects negatively gross margin as one of the key indicators of value creation. Protection against price risk can be achieved by negotiating the prices at which the farmers will deliver their products. Namely, the sensitivity analysis conducted in the paper indicates that in the case of a decrease in prices and yields (production value) by 20%, the gross margin decreases by about 50%. Contracted farming is one of the options that can reduce price risk on the sales side and can contribute to the improvement of the profitability for farmers, and thus the sustainability of this production.

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Conflict of interests

The authors declare no conflict of interest.

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THE IMPORTANCE OF A REALISTICALLY DETERMINED AMOUNT OF TAX ON PROPERTY RIGHTS RELATING TO THE OWNERSHIP OF AGRICULTURAL LAND IN THE REPUBLIC OF SERBIA ADOPTED BY TAX AUTHORITIES OF LOCAL SELF-GOVERNMENT UNITS

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A R T I C L E   I N F O

A B S T R A C T

It has been argued for a long time in academic papers which corporate governance factors have a significant impact on gains of a great number of businessmen. However, such studies rarely examine the impact taxation issues on agriculture. This paper differs from other published papers because its focus is tax on agricultural land in an economy in transition. The primary aim of the authors was to find rules in taxpayers' conduct after being served tax decisions issued by local tax authorities with the assessed tax. The following aim was to find out how tax authorities respond to receiving complaints on the assessed tax lodged by the affected tax payers. The conclusions are as follows: first, there is a difference in tax amounts assessed by local tax authorities relating to property rights of taxpayers resulting from their ownership of agricultural land: second, there is a significant difference in tax amounts assessed following the complaints lodged by taxpayers in all four categories of tax rates set by tax authorities for the four respective zones.

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Introduction

Tax authorities of the state (Anwar & Sun, 2015; Boukalova, et all, 2016; Murphy, 2019) are taxing in accordance with the adopted tax policy (Cantino, 2009; Soltani, 2009; Cai & Wong, 2010; Nowak, et all., 2016; Ugrenović, et all., 2021) based on ownership over agricultural land. Transitional countries (Santos Curto & Dias, 2014; Rymanov, 2017; Rodriguez, et all., 2019; Vitomir, et all., 2021), like the Republic of Serbia, adapted continuous agricultural policy to internal socio-economic conditions (Popović, 2014) on the one hand, and on other conditions that prevail in the EU (Williams, 2010; Popović, et all., 2014a; Scalera, 2016; Wynen & Verhoest, 2016; Novaković, et all., 2018; Wang, 2019)

In addition, countries that want to join the EU are continuously aligning their land management policy (Popović, et all, 2015; Popović, et all., 2018; Radović et all, 2021; Popović, et all., 2021) with agrarian policy in the EU (Barlev & Hhaddad, 2003; Barker & McGeachin, 2013; Aczel, 2015; Bozzolan, et all., 2016; Chen, et al., 2017; Alibegović, et all., 2018). Issues related to the management of agricultural enterprises are related to the resolution of internal management decisions (Baráth & Fertő, 2017; Baker, et all., 2018) but also for the issues of resolving fair valuation both in enterprises and in the economy of the country (Brown & Szimayer, 2008; Brousseau, et all., 2014; Bratten, et all., 2016).

This paper aims to analyze the impact of the value of the tax on property rights over agricultural land in the Republic of Serbia. The authors point out that agricultural land is constantly under pressure to spread the demand and desire of the population to turn part of the agricultural land into a space for other production-business purposes.

For this reason, the authors have done the research in order to draw the attention of the expert public to the behavior of the transitional country in the conduct of tax policy regarding the existence of ownership over the land in accordance with the distance from the center of the Municipality and the City.

A transitional country on the path to the EU should harmonize tax policy with the generally accepted policy of countries it seeks to join, with the emphasis on the specific features.

Material and methods

This paper deals with the 2014-2019 period and the research was conducted in the Republic of Serbia. It examines the impact of the amount of tax on agricultural property assessed by local tax administrations. Taxation is a very sensitive issue which might have an impact on a great number of individuals.

The research this paper is about is based on a broader framework of tax rates and it relates to property rights resulting from the ownership of agricultural land. Tax amount management depends on the local self government or city policy as local tax units assess tax to a great number of taxpayers.

In the period under consideration, 2014-2019, taxpayers were subject to tax on agricultural land if its size exceeded 1/10 ha. In addition to that, agricultural land possessed by a taxpayer needed not be comprised in one plot. The amount of tax was assessed by tax authorities of local self governments or cities on the basis of data stipulated in agricultural land sales agreements concluded in the previous year.

When assessing the tax amount, tax authorities take into account the average value of agricultural land sold, as provided for by the law, and its distance from the centre of the respective place or city. It is provided for by the law that a maximum tax rate set shall be 0.4% of the market value of agricultural land.

Methods and current research theoretical assumptions and basis of statistical analysis used

The authors took into account the already published papers (Vukadinović, 1990) and used a relevant sample (size marked with p) of municipalities or cities in the Republic of Serbia (marked with N), or pairs of causal data (value of sales tax on agricultural land is marked with X) as well as (the value of sales tax on agricultural land determined after the appeal of taxpayers, which is marked with Y).

It was essentially a linear equation:

$$\gamma = \alpha + \beta\chi$$

Based on that, it was necessary to determine: α, β.

This could be described by the linear dependence of what was said. The distribution itself belonged to the group of so-called normal distributions, i.e. N $(0, \sigma2)$, where E $(x) = 0$ (mathematical expectation) where the tax rate from tax solutions is classified by zones away from the center of the municipality or cities.

The authors performed the observation for the interval 1-4 in the observed 6 cities, which are essentially a representative sample that was processed in the study, where the tax rate was 0.3; 0.2; 0.25; and 0.4. Thus, for each pair of causal data, it was valid (i = number of municipalities or cities).

$$\gamma j = \alpha + \beta\chi_i$$

At the same time, the coefficients α and β are minimized by using the following expression.

$$\sum_{i=1}^{n} (Yi - Yj)^2 = \sum_{i=1}^{n} (Yi - (\alpha + \beta\chi i))^2$$

Based on that, a system of equations was obtained.

$$\sum_{i=1}^{n} Yj = n\alpha + \beta \sum_{i=1}^{n} \chi j$$

$$\sum_{i=1}^{n} x_i \, Y_i = \alpha \sum_{i=1}^{n} x_i + \beta \sum_{i=1}^{n} x^2$$

The mentioned system of equations has a unique solution in α and β.

$$\alpha = \frac{\sum_{i=1}^{n} Y_i}{n} - b \frac{\sum_{i=1}^{n} x_i}{n}$$

$$\beta = \frac{n \sum_{i=1}^{n} x_i \, y_i - (\sum_{i=1}^{n} x_i)(\sum_{i=1}^{n} Y_i)}{n \sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} x_i)^2}$$

Therefore, E (α) = α; and E (β) = β.

After that, the authors took into account the relative measure of representativeness, because it can be used to observe which part of the variability of the feature Y can be explained by changing the feature X.

Essentially, it is the coefficient of determination r2.

$$r^2 = \left[\frac{n \sum_{i=1}^{n} x_i \, Y_i - (\sum_{i=1}^{n} x_i)(\sum_{i=1}^{n} Y_i)}{\sqrt{n \sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} x_i)^2} \ \sqrt{n \sum_{i=1}^{n} Y_i^2 - (\sum_{i=1}^{n} Y_i)^2}} \right]$$

The value of the coefficient of determination ranged from 0 to 1, where $0 \leq r^2 \leq 1$. is valid.

The authors point out that if the coefficient is closer to the value of 1, it is possible to describe the dependence of the obtained data, which are presented in the further part of the study.

It is also possible to obtain values of 4 states.

1) $0,7 < |r| \leq 0,8$ (pronounced linear correlation);
2) $0,8 < |r| \leq 0,9$ (high linear correlation);
3) $0,9 < |r| \leq 1$ (very high linear correlation) and
4) $r| = 1$ (perfect linear correlation).

The authors used the settings to set the hypotheses.

$$H_{0 \, :} \, \mu = \mu_0$$

$$H_{1 \, :} \, \mu \neq \mu_0$$

The authors made the acceptability of the set hypotheses with the level of significance α on the basis of the given expression.

$$\left[\frac{\bar{x} = \mu_0}{\frac{\sigma}{\sqrt{n}}} \right] > Z_{\frac{\alpha}{2}}$$

The authors did not accept the set hypotheses with the level of significance α on the basis of the following assumption.

$$\left[\frac{\bar{x} = \mu_0}{\frac{\sigma}{\sqrt{n}}} \right] \leq Z_{\frac{\alpha}{2}}$$

Research goals set

This study is based on a research assumption to find rules relating to the conduct of a great number of taxpayers after they are served tax decisions containing tax amounts due by them, issued by local tax authorities and relating to their property rights resulting from their ownership of agricultural land. The authors set a primary research goal which is to determine the relationship between the tax rate and the remoteness of the land in question from the centre of a local self government unit issuing tax decisions to tax payers on their respective territory.

The next goal of the authors was to deal with the issue of setting the amount of tax resulting from the ownership of agricultural land. The authors conducted a representative survey comprising approximately 31% of the population of the Republic of Serbia living in the three selected municipalities and three cities.

The research was conducted on a random sample by having an insight into 127 issued tax decisions to individual taxpayers and by having an insight into their complaints on the amounts of tax assessed on the basis of their ownership of agricultural land. The range of tax rates was from 0.2 to 0.4% in the three municipalities and three cities under consideration. The population of the said municipalities varied from 26.000 to 88.000, and the population of cities varied from 132.000 to 2 million.

Tax amounts are set on the basis of 4 zones, depending on the remoteness of agricultural land from the centre of local municipalities or cities. One should bear in mind that zone 1 is closest to the centre and the amount of the respective tax is the highest, whereas zone 4 is the most distant from the centre and therefore the tax amount assessed is the lowest.

Hypotheses

In order to reach valid positions relating to the application of tax rates on agricultural land the authors set the following hypotheses:

H1: There is no difference in setting tax rates by tax bodies of local self governments and cities applicable to taxpayers on the basis of their ownership of agricultural land;

H2: There is no difference in the tax amounts assessed to taxpayers on the basis of their ownership of agricultural land by local tax authorities irrespective of the size of municipalities or cities, measured by the population of the respective places and cities on the one, and with regard to the position of agricultural land or a zone in relation to the centre of a place or city on the other hand.

H3: There is no difference in the amount of subsequently assessed amounts of tax on property rights resulting from the ownership of agricultural land as a result of complaints lodged by taxpayers to local tax authorities.

Statistical analyses

The statistical software program SPSS IBM was used for data processing. As an initial insight into the data, descriptive statistics were made, more precisely, the frequencies of the representation of the used variables in the sample were calculated, and then the absence of extreme values and the missing data were determined.

After that, in order to gain further insight into the relations of the used indicators, the Crosstabs option, or cross frequencies, was made in order to see the mutual relations of the variables. Given the need to respond to the needs of the first hypothesis in question, the Hi square test analysis was carried out, which corresponds to the need to monitor the differences between the variables of the categorical type.

For the needs of the second and third hypotheses, a multivariate analysis of variance was carried out, with follow-up post-hoc tests (Tukey HSD), to track differences in the categories of independent variables. Subsequently, for the purposes of the last hypothesis, a t-test for repeated measurements, as well as accompanying descriptive indicators, was made in order to gain insight into the changes in the displayed pairs of variables.

Future Impacts

The obtained results in the work can serve as guidelines for further research that monitors the tax issues related to the formation of a tax base based on ownership over agricultural land in the Republic of Serbia. In addition, the results point to the future directions that the tax authorities must undertake to reduce the dissatisfaction of taxpayers in large cities because they are in an unequal position in relation to taxpayers of small and medium-sized municipalities and cities.

By doing so, it essentially imposes substantive work on balancing the amount of tax under the ownership of agricultural land, which would accelerate state tax administration, and reduce the taxpayers' dissatisfaction with the ruthless management of state bodies.

The results of the research may be relevant for other countries, especially for the countries of the Western Balkans, as well as for a large number of transition countries.

Results and Discussions

The amount of tax created by tax authorities of local governments of the Municipality and the City can have a large number of implications for the life of an ordinary person, but also of legal persons who exist in a particular location.

There are permanent measurable impacts in the form of demands for agricultural areas to be converted into areas where some other activity in relation to agriculture will take place as they can achieve higher profit rates than agriculture.

Unrealistically high tax rates by state authorities imply dissatisfaction with taxpayers, which essentially means that the management of state bodies is not in the function of normal economic functioning.

Tax rate

The tax rate based on ownership over agricultural land is manifestly manifested in terms of the nominal amount of tax that the tax authority of the local self-government delivers to the taxpayer on that basis.

The basis of the research results is based on the H1 setting: there is no difference in terms of determining the tax rate based on ownership over agricultural land in the Republic of Serbia.

On this basis, the authors presented the results of the research in Table 1 and Table 2, where they essentially analyzed 3 Municipalities and 3 Cities in relation to the tax rates formed by the tax authorities of the analyzed local governments.

Table 1. Frequency of local self-governments crossed with tax rates

Local governments	Tax rate				Total
	0.3	0.2	0.25	0.4	
A	23	0	0	0	23
B	23	0	0	0	23
C	0	20	0	0	20
D	0	0	20	0	20
E	0	0	0	20	20
F	21	0	0	0	21
Total	67	20	20	20	127

Note refers to the symbols of the designated municipalities and cities: (A=Zrenjanin; B=Kanjiža; C=Ruma; D=Sremska Mitrovica; E=Novi Sad; F=Beograd)

Source: authors' calculation

The frequencies shown in Table 1 provide an initial insight into the different levels of tax rates brought by tax authorities of local self-government units. In addition, it can be noted that the rate of tax on property rights over agricultural land is higher in the largest cities (Novi Sad (E) and Belgrade (F)) compared to smaller municipalities and cities.

In order to strengthen the results presented in Table 1, the authors carried out a Hi square test to establish a statistical confirmation. After that, the authors presented the results of the research in Table 2.

Table 2. Display results Hi square test

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	381.000[a]	15	.000
Likelihood Ratio	307.507	15	.000
Linear-by-Linear Association	23.570	1	.000
N of Valid Cases	127		

Source: authors' calculation

The results obtained after the conducted QQ square test, support the existence of a statistically significant difference between the established tax rate by the tax authorities of the local self-government units in relation to the size of the municipality and the city, as the value obtained (p = .00) is such that the tax rates are higher in larger municipalities and larger cities in the Republic of Serbia. Essentially, based on the results disclosed in Table 1 and Table 2, H1 can be completely rejected.

Tax rate in relation to the number of inhabitants of the local self-government and zoning

The tax rate based on ownership over agricultural land is continuously delivered to taxpayers through the decision of tax authorities. This statement was the basis for the formation of another hypothesis by the author. Namely, the authors proceeded from the assumption that there is no difference in terms of the amount of tax due to ownership over agricultural land, which, in the form of a decision to the taxpayer, is submitted by the tax authorities of the local self-government of the Municipalities and the City, regardless of their size measured by the number of inhabitants in relation to the zone in which the agricultural parcel is located.

Using the multivariate ANOVE, the authors presented the results in Table 3, which indicate that there are differences in the amount of the taxpayer's tax base in relation to the size of the local self-government units measured by the number of inhabitants.

Table 3. Multivariate ANOVA

Number of inhabitants of local self-government	Value	F	Hypothesis df	Error df	Sig.
Pillai's Trace	.545	36.525[b]	4.000	122.000	.000
Wilks' Lambda	.455	36.525[b]	4.000	122.000	.000
Hotelling's Trace	1.198	36.525[b]	4.000	122.000	.000
Roy's Largest Root	1.198	36.525[b]	4.000	122.000	.000

Source: authors' calculation

The results show in Table 3 shows the significance of the difference (p = .00) between the tax rate as the outcome of the variable, that is, the linear score obtained on the basis of different zones (existence of 4 zones) and the size of local self-governments, expressed by the number of inhabitants.

After that, the authors deepened the research by applying comparisons across zones. This was done to gain insight into the differences, for each of the zones individually. The results are given in Table 4.

Table 4. Number of inhabitants of local self-government in relation to the amount of tax formed by zones

Number of inhabitants of local self-government	Type III Sum of Squares	df	Mean Square	F	Sig.
Zone1	510167043829.635	4	127541760957.409	36.525	.000
Zone2	432131860329.277	4	108032965082.319	42.744	.000
Zone3	379891855740.873	4	94972963935.218	42.389	.000
Zone4	371459115366.858	4	92864778841.714	47.182	.000

Source: authors' calculation

Based on the results presented in Table 4, there is a significant difference in taxpayers' tax amount in each of the four zones, as well as the existence of an impact in relation to the size of the local self-government measured by the number of inhabitants (p = .00).

In addition, with the help of MANOVA techniques, the authors carried out analyzes on different subgroups of variables, such as the number of residents of local self-government expressing the size of local self-government.

A Post-hoc Tukey HSD test was applied, which tested the existence of an individual difference. Essentially, based on the results disclosed in Table 3 and Table 4, H2 can be reliably dropped.

The amount of tax after the taxpayer's appeal

Item H: 3 that there is no difference in the amount of tax on property rights over agricultural land in the Republic of Serbia, which tax authorities submit to taxpayers and subsequently handed down final decisions to taxpayers after the complaints of taxpayers have been declared. In addition, the authors expanded the observation of the level of tax solutions before and after appeals against 4 zones in order to obtain representative indicators.

The results of the research were shown by the authors in Table 5.

Table 5. Arithmetical mean of the tax amount per zone, before and after appeal

	Mean	N	Std. Deviation	Std. Error Mean
Zone1	61633.07	127	86197.633	7648.803
Complaint -Zone1	2955.91	127	576.477	51.154
Zone2	54610.24	127	76660.498	6802.519
Complaint -Zone2	2370.08	127	724.658	64.303
Zone3	51334.65	127	72002.820	6389.217
Complaint Zone3	2210.24	127	641.283	56.905
Zone4	49498.43	127	69669.314	6182.152
Complaint -Zone4	1864.57	127	613.024	54.397

Source: authors' calculation

This gave an initial view of the achieved average values of tax rates per zone, before and after appeal to the decisions of the tax authorities. After the presentation of Table 5, large differences were observed, which were further tested with appropriate statistical tests.

Subsequently, the authors carried out the T-test, which carried out repeated measurements in order to confirm the significance of the previously reported differences in the amount of tax before and after the taxpayers' filed complaints by zones (Table 6).

Table 6. Presentation of established tax to taxpayers before and after the appeal in zones

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Zone1 - Complaint-Zone1	58677.165	85723.743	7606.752	43623.627	73730.704	7.714	126	.000
Zone2 - Complaint-Zone2	52240.157	76008.151	6744.633	38892.727	65587.588	7.745	126	.000
Zone3 - Complaint-Zone3	49124.409	71479.794	6342.806	36572.183	61676.636	7.745	126	.000
Zone4 - Complaint-Zone4	47633.858	69261.147	6145.933	35471.238	59796.479	7.750	126	.000

Source: authors' calculation

Essentially, on the basis of the results disclosed in Table 5 and Table 6, H3 can be rejected because the significance of the difference (p = .00) was obtained in all four observed zones where the agricultural parcel of the taxpayers was located, which was compared with the amount of tax solutions before and after the appeal of taxpayers.

Conclusion

The authors in this paper indicate in a comprehensive way the significance of a realistic and fairly determined amount of tax on property rights relating to agricultural land in the Republic of Serbia. Besides, the authors point out in a transparent way that the amount of tax stated in tax decisions served to taxpayers by local tax authorities needs to be realistic because, being contrary to that, it could lead to a number of undesired consequences. Unreasonably high taxation can reduce trade in agricultural land and in a more drastic event, it could result in failure to register trade in agricultural land, as taxpayers will not be willing to pay unreasonably high tax. As a less drastic option, in case of high tax amounts assessed to the owners of agricultural land, taxpayers will lodge complaints on the tax decisions made by tax authorities and served upon them, which would result in problems in the functioning of bodies of local self-government units.

When this study is concerned, the first conclusion we reach at is that there are differences in the rates of tax on property rights resulting from the ownership of agricultural land. H:1 is rejected as results presented in Table 1 show that tax decisions issued by local self-governments prove there are different tax rates on the state level set by tax units of local self-governments or cities, and the greatest discrepancy is visible in two biggest cities in the Republic of Serbia the population of which accounts for approximately 1/3 of the total population. This is statistically confirmed by the results shown in Table 2. The authors determined by applying the Chi squared test that there were statistically significant differences between tax rates set by municipalities and cities (p = .00). We point out that it is undoubtedly determined that tax authorities in big cities made tax decisions in which far higher tax rates were applied in assessing tax amounts charged to the respective taxpayers.

The second conclusion relating to the study is that there are differences in tax decisions issued to taxpayers by tax units of local self-governments and cities with regard to the population of the respective municipalities and cities. H: 2 is rejected after presenting the obtained results (Table 3), as there is a significant difference (p = .00). The results are supported by comparing the population and zones in which agricultural land is located (Table 4), as it is found that there is a difference in tax amounts (p = .00) in all municipalities and cities if local self-government size factor is taken into account, or in other words, the number of inhabitants relative to the zoning.

The third conclusion relating to the study is that there are differences in tax decision amounts served before and following the complaints lodged by taxpayers (Table 5) with regard to the zones in which agricultural land in located. The results obtained require rejection of H: 3, in particular after repeating the tests, as there is a high level of significance (p = .00) visible in Table 6. The authors point out that ununiformly assessed tax in different local self-government units in the country leads to dissatisfaction of taxpayers who, instead of focusing on the organization of their agricultural activities, waste time and energy on lodging complaints on tax decisions issued by local tax units. The results confirming that are shown in Table 5 (Std. Deviation prior to final complaint in zone 1 = 86197.633, and eventually being 576.477 following the complaint lodged by taxpayers). The last observation is evident after comparing the arithmetic mean (medium for zone 1 = 58677.165, zone 4 = 47633.858), (Table 6).

This study does not exhaust a possibility of a comprehensive observation of setting tax rates of property tax relating to agricultural land ownership. The study indicates there is a need to impose a realistic tax on property rights relating to the ownership of agricultural land as part of national level tax policy. By accepting the main conclusions of the study there would be numerous benefits both for the state and taxpayers. Therefore, the authors believe the study meets the above stated research requirements. There is a possibility of upgrading the research in order to find additional benefits for all parties mentioned in the study.

Conflict of interests

The authors declare no conflict of interest.

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THE ROLE AND SIGNIFICANCE OF GASTRONOMIC TOURISM FOR RURAL AREAS OF THE MUNICIPALITY OF APATIN

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ARTICLE INFO	ABSTRACT
	The paper starts with the initial hypothesis that traditional, i.e. local food served in local restaurants (chardas) is the basis for the development of rural areas. By setting certain sub-hypotheses, we highlight the primary purpose of the paper, and thus we show that traditional food has the "strength" to change and improve rural areas. We based the research on a changed questionnaire previously used for research in the Black Sea resorts of Romania. The questionnaire comprises of 9 attributes, and we asked respondents to rank certain attributes on a three-point scale. The research was conducted among visitors who came from eight countries, including Serbia, to get the most relevant data through statistical processing, which will serve to assess the current, but also to predict the future state and development of gastronomic tourism. © 2021 EA. All rights reserved.

Introduction

Since food and beverage are recognized as important factors in attracting tourists, we consider gastronomic tourism to be the backbone of the development of rural areas. (Hall, Mitchell, 2001; Hjalager, Richards, 2002; Charters, Pettigrew, 2005; Wolf, 2006; Petrović et al., 2017; Vuković et al., 2019; Vujko et al., 2020). Food has the "power" to attract tourists contributing to the transformation of rural areas into tourist destinations. It is well

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known that tourists travel to different parts of the world just to try something new and to experience through "taste" new destinations in this specific way. (Kivela, Crotts, 2006).

The municipality of Apatin is in the southwest part of the province of Vojvodina (West Bačka District), on the left side of the Danube. It occupies the space of 333 km², with approximately 35,000 inhabitants in one urban and four rural areas (Prigrevica, Kupusina, Svilojevo, and Sonta), (Radujko, 2008; Bošković, 2013; Tadić, 2018). Regional route R 101 connects Apatin and Sombor (16 km) and the borders with the Republic of Croatia near Bogojevo (35 km). Apatin is 100 km away from Novi Sad, via Odžak, and 120 km via Vrbas Two geomorphologic environments are represented in the municipality's relief: the alluvial plain of the Danube and the light terrace, with an average altitude of 85 m (Radujko, 2008; Bošković, 2013; Tadić, 2018).

The tourist attractions in the region are the very rich fishing waters on the Danube and its branches, as well as famous hunting places, habitats of the famous Danube deer and other game animals. Apatin has long been known as a fishing center. The floodplain of the special nature reserve "Gornje Podunavlje" is a natural hatchery for about 50 species of freshwater fish, among which the most important species are: carp, pike, perch, catfish, etc. (Rudić-Vranić, 1960; Ćopić, 2016). Also, the Apatin fishing culinary tradition is well known, as well as the manifestation "Apatin Fishermen's Evenings".

The paper tries to show that food and gastronomic tourism are a powerful magnet for attracting tourists, and a mighty instrument with the help of which the invested money will return many times. Such investment directly affects the development of rural areas, which is the starting hypothesis of the paper. The primary aim of the paper is to prove that traditional food has the "strength" to change and improve rural areas, and gastronomic tourism represents the backbone of development. What we conclude is that certain items influence the overall impression which gastronomy makes on tourists. Thus, new aims of the paper emerged, i.e. to investigate whether tourists are satisfied with their stay at the destination and whether this stay fulfilled their expectations; also, to check the quality of the food that was served, as well as to check the quality of the service in chardas.

The research methodology

The survey was conducted among the guests of three well known chardas on the territory of the municipality of Apatin, "Zlatna Kruna", "Harčaš" charda, and "Kupusinska" charda from May until September 2018, and included 234 participants of different gender, age, and educational background.

The quantitative-qualitative method, which is one of the most used methods, is used in this paper because it allows great freedom in research and evaluation, and is based on the following indicators: accessibility of resources, tourist equipment, environment, resource specificity, resource significance, and artistic value. For this paper, we did the valorization of gastronomic tourism on the Danube chardas of the municipality of Apatin: Charda"Zlatna kruna" (Golden Crown), "Harčaš" charda, and "Kupusinska"

charda. Valorization was performed by Dragan Ignjatov and Đurđina Knezević. Locating the destination or zoning, was done by drawing and connecting points on the map of Apatin. A tour of the city during the visit to the Apatin chardas is shown.

We based this study on a changed questionnaire that was primarily conducted in the Black Sea resorts of Romania in August 1997 and implemented by Nield, Kozak & LeGrys (2000). According to Nield, Kozak & LeGrys (2000), the participants were asked to rate nine attributes (Value for money, Food quality, Number of dishes, Standard of food service, Variety of dishes, Food presentation, Overall traditional meal experience, Speed of service, Attractiveness of surroundings) of food service (on a three-point scale).

A three-point scale, although unusual, was employed to give unequivocal answers regarding tourists' likes and dislikes. Within the three-point scale, the item `like' refers to the respondents' favorite opinions about the food and beverage and the item `dislike' refers to their unfavorable opinions. The item `neither' was inserted for those who neither liked nor disliked an item. By applying the appropriate research instruments, the survey included variables that primarily concerned the participants' opinions of the linkage between traditional food and loyalty. The variables reflect the opinion of the participants about the food, food service, the attractiveness of surroundings, and loyalty.

The collected data was analyzed by employing the Statistical Package for the Social Sciences (SPSS) program. This data was analyzed by appropriate statistical methods which were descriptive and comparative, enabling the explication of the research results and the performing certain conclusions.

One form of the analysis of the data was the chi-square test (Pearson Chi-Square Test). It was used to determine whether a received (observed) frequency (the responses of participants compared to the origin country) deviated from the frequencies that were expected. This test aimed to check if there was a connection between these groups of participants and the probability of connection. Practice is to always start from the premise that there are certain values of the difference in responses. To detect differences in the responses measured based on statistically significant differences in the distribution of the dependent variable to an independent one, statistically significant differences are taken for those having $p < 0,05$.

In this paper, we started from the main hypothesis H: Traditional food is the reason for the development of the rural areas. Certain lower-level hypotheses are set under the main one: h1-staying at the destination fulfilled the expectations (Table 1); h2-the traditional food is presented in the right manner (Table 11); h3-the environment that surrounds the Apatin chardas (national restaurants) is attractive and improves the overall impression (Table 13, 17); h4-the food and service in the restaurants represent the product which becomes the basis of tourist loyalty (Table 3, 5, 7, 9, 15)

Results and discussion

According to Günther (2021), money can strongly 'affect people's reactions. It is well established that Value for money, Food quality, Number of dishes, Standard of food service, Variety of dishes, Food presentation, Overall traditional meal experience, Speed of service, and Attractiveness of surroundings affect customer's willingness to pay a food price. That feeling is directly proportional to the need of enjoying food, and also with "the wish to be seen" at a certain destination (Mora et al., 2021).

Table 1. Opinion of the participants

			Value for money			Total
			Like	Dislike	Neither	
Country of origin	Serbia	Count	37	1	1	39
		% of Total	12,5%	,3%	,3%	13,2%
	B&H	Count	56	3	2	61
		% of Total	19,0%	1,0%	,7%	20,7%
	Croatia	Count	22	1	1	24
		% of Total	7,5%	,3%	,3%	8,1%
	Macedonia	Count	7	0	0	7
		% of Total	2,4%	,0%	,0%	2,4%
	Montenegro	Count	34	2	1	37
		% of Total	11,5%	,7%	,3%	12,5%
	Slovenia	Count	74	3	2	79
		% of Total	25,1%	1,0%	,7%	26,8%
	Greece	Count	22	1	2	25
		% of Total	7,5%	,3%	,7%	8,5%
	Hungary	Count	18	3	2	23
		% of Total	6,1%	1,0%	,7%	7,8%
Total		Count	270	14	11	295
		% of Total	91,5%	4,7%	3,7%	100,0%

Source: Own calculations

By examining table 1, we see that most participants claimed they received what they expected for the money, which proves the hypothesis h1 - staying at the destination fulfilled the expectations. In Pearson Chi-Square Test, comparisons are made depending on the country from which tourists come. Referring to the data from table 2, we can conclude that there is no statistically significant difference in participants' responses depending on the country they come from, since p=8.515. Therefore, wherever participants come from, they all agree that they got the highest value for the money spent, and all of them were satisfied.

Table 2 Pearson Chi-Square Test

Attachment 1.	Value	df	Statistical significance (p)
Pearson Chi-Square Test Male	8.515	14	0.861

Source: Own calculations

For Mak et al. (2012b), quality of food, number of dishes, and quality of service significantly impact tourist satisfaction and thus affect the perception of gastronomic tourism and rural areas. In this sense, food positively affects satisfaction and intentions to return to a destination. Apart from this, food quality in relation to quality service directly influences the positive aspects of rural areas' development. When one talks about food quality, it is primarily about the quality of the ingredients they made a certain dish of. Organic products are ecologically grown and healthy habits are valued most.

Table 3. Opinion of the participants

			Food quality		Total
			Like	Neither	
Country of origin	Serbia	Count	38	1	39
		% of Total	12,9%	,3%	13,2%
	B&H	Count	61	0	61
		% of Total	20,7%	,0%	20,7%
	Croatia	Count	24	0	24
		% of Total	8,1%	,0%	8,1%
	Macedonia	Count	7	0	7
		% of Total	2,4%	,0%	2,4%
	Montenegro	Count	37	0	37
		% of Total	12,5%	,0%	12,5%
	Slovenia	Count	74	5	79
		% of Total	25,1%	1,7%	26,8%
	Greece	Count	25	0	25
		% of Total	8,5%	,0%	8,5%
	Hungary	Count	23	0	23
		% of Total	7,8%	,0%	7,8%
Total		Count	289	6	295
		% of Total	98,0%	2,0%	100,0%

Source: Own calculations

Pearson Chi-Square Test (p=11.044 in the case of table 4, also showed that there was no statistically significant difference in participants' responses depending on the country they come from. Participants in the largest number of cases (98%), responded that the quality of food served in 'salash' is excellent and that they were very satisfied. Researching the term "food quality", certain authors conclude tourists are satisfied if all organoleptic properties of food are satisfied (Jovićević, Simin, 2021; Čavić et al., 2021), and in the case of 'salash' in Serbia, hospitable and helpful staff is adding to a sense of satisfaction.

Table 4. Pearson Chi-Square Test

Attachment 1.	Value	df	Statistical significance (p)
Pearson Chi-Square Test Male	11.044	7	0.137

Source: Own calculations

According to Okumus et al. (2007), the sensory experience seemed to be the primary determinant of satisfaction. Thus, several gangs that are served, and also the colors of dishes that are served on the plates, matching the ingredients and spices, the smell of the dish (table 9), as well as the psychological moment i.e. the impression that something is of better quality if there is more of it. By examining tables 3 and 9, it can be concluded that a total number of 98% of participants agreed that the quality in chards is at the top level.

Table 5. Opinion of the participants

			Number of dishes			Total
			Like	Dislike	Neither	
Country of origin	Serbia	Count	37	1	1	39
		% of Total	12,5%	,3%	,3%	13,2%
	B&H	Count	60	0	1	61
		% of Total	20,3%	,0%	,3%	20,7%
	Croatia	Count	23	1	0	24
		% of Total	7,8%	,3%	,0%	8,1%
	Macedonia	Count	6	0	1	7
		% of Total	2,0%	,0%	,3%	2,4%
	Montenegro	Count	37	0	0	37
		% of Total	12,5%	,0%	,0%	12,5%
	Slovenia	Count	78	0	1	79
		% of Total	26,4%	,0%	,3%	26,8%
	Greece	Count	25	0	0	25
		% of Total	8,5%	,0%	,0%	8,5%
	Hungary	Count	23	0	0	23
		% of Total	7,8%	,0%	,0%	7,8%
Total		Count	289	2	4	295
		% of Total	98,0%	,7%	1,4%	100,0%

Source: Own calculations

Data in table 6 also show that there was no statistically significant difference in participants' responses depending on the country they come from (p=18.695). The number of gangs which is served at 'salash' is at the pleasure of participants and they all agreed that they ate and drank very well at 'salash'. Certain researchers concluded that traditional food is something people love and always return to (Lončarić et al., 2021), and 'salash' itself is a place where traditional dishes are served. Primarily this also means a traditional way of serving food is respected, which means several gangs (small dishes), from appetizer to dessert.

Table 6. Pearson Chi-Square Test

Attachment 1.	Value	df	Statistical significance (p)
Pearson Chi-Square Test Male	18.695	14	0.177

Source: Own calculations

The way something is served, as well as the people who are serving food also influence the guest's perception and his wish to visit the destination again (Perić et al., 2020). According to Rozin and Rozin (1981), the standard of food service represents the "ID" of the restaurant, and of the destination itself. Analyzing data from table 7, we can conclude that the respondents support this statement.

Table 7. Opinion of the participants

			Standard of foodservice			Total
			Like	Dislike	Neither	
Country of origin	Serbia	Count	31	4	4	39
		% of Total	10,5%	1,4%	1,4%	13,2%
	B&H	Count	58	0	3	61
		% of Total	19,7%	,0%	1,0%	20,7%
	Croatia	Count	24	0	0	24
		% of Total	8,1%	,0%	,0%	8,1%
	Macedonia	Count	5	0	2	7
		% of Total	1,7%	,0%	,7%	2,4%
	Montenegro	Count	36	0	1	37
		% of Total	12,2%	,0%	,3%	12,5%
	Slovenia	Count	76	0	3	79
		% of Total	25,8%	,0%	1,0%	26,8%
	Greece	Count	23	1	1	25
		% of Total	7,8%	,3%	,3%	8,5%
	Hungary	Count	23	0	0	23
		% of Total	7,8%	,0%	,0%	7,8%
Total		Count	276	5	14	295
		% of Total	93,6%	1,7%	4,7%	100,0%

Source: Own calculations

Data in table 8 also show there was no statistically significant difference in participants' responses depending on the country they come from (p=36.709).

Table 8. Pearson Chi-Square Test

Attachment 1.	Value	df	Statistical significance (p)
Pearson Chi-Square Test Male	36.709	14	0.001

Source: Own calculations

Data in table 9 show that almost 100% of tourists agreed that food and beverage which is served at 'salash' is diverse and abundant. According to authors Čavić et al., (2020), innovation and diversity of food present positive aspects of tourism development in a certain area, thus this piece of information is in correspondence with the stated facts.

Table 9. Opinion of the participants

			Variety of dishes			Total
			Like	Dislike	Neither	
Country of origin	Serbia	Count	38	1	0	39
		% of Total	12,9%	,3%	,0%	13,2%
	B&H	Count	60	0	1	61
		% of Total	20,3%	,0%	,3%	20,7%
	Croatia	Count	24	0	0	24
		% of Total	8,1%	,0%	,0%	8,1%
	Macedonia	Count	7	0	0	7
		% of Total	2,4%	,0%	,0%	2,4%
	Montenegro	Count	37	0	0	37
		% of Total	12,5%	,0%	,0%	12,5%
	Slovenia	Count	79	0	0	79
		% of Total	26,8%	,0%	,0%	26,8%
	Greece	Count	25	0	0	25
		% of Total	8,5%	,0%	,0%	8,5%
	Hungary	Count	23	0	0	23
		% of Total	7,8%	,0%	,0%	7,8%
Total		Count	293	1	1	295
		% of Total	99,3%	,3%	,3%	100,0%

Source: Own calculations

Table 10 shows that participants' responses depending on the country they come from, statistically do not defer (p=10.429), which is corresponding to the research conducted by Brankov et al., (2019), according to which the diversity itself is the key to duration, and thus is the quality.

Table 10 Pearson Chi-Square Test

Attachment 1.	Value	df	Statistical significance (p)
Pearson Chi-Square Test Male	10.429	14	0.730

Source: Own calculations

Food presentation refers to the arrangement of food on the plate in a way that fulfills all organoleptic properties. According to Björk and Kauppinen-Räisänen (2018), food was described as hedonism, and food tourism was a journey in search for taste stimulation which is more than a combination of smell, taste, which is beautiful to the eye and which is arranged and served properly. All this represents food presentation. By examining Table 11 it can be concluded that approximately a half of participants stated that food presentation in chards is done properly, while another half of participants had different statements, 18% voted for inadequate presentation and 27,5% were undecided.

Table 11. Opinion of the participants

			Food presentation			Total
			Like	Dislike	Neither	
Country of origin	Serbia	Count	19	6	14	39
		% of Total	6,4%	2,0%	4,7%	13,2%
	B&H	Count	43	11	7	61
		% of Total	14,6%	3,7%	2,4%	20,7%
	Croatia	Count	12	4	8	24
		% of Total	4,1%	1,4%	2,7%	8,1%
	Macedonia	Count	2	4	1	7
		% of Total	,7%	1,4%	,3%	2,4%
	Montenegro	Count	28	2	7	37
		% of Total	9,5%	,7%	2,4%	12,5%
	Slovenia	Count	32	19	28	79
		% of Total	10,8%	6,4%	9,5%	26,8%
	Greece	Count	14	5	6	25
		% of Total	4,7%	1,7%	2,0%	8,5%
	Hungary	Count	11	2	10	23
		% of Total	3,7%	,7%	3,4%	7,8%
Total		Count	161	53	81	295
		% of Total	54,6%	18,0%	27,5%	100,0%

Source: Own calculations

Authors Marković et al., (2019) showed in their research that an excellent presentation is a competitive advantage itself, and by analyzing table 12 we conclude that there is no statistically significant difference in participants' responses depending on the country they come from (p=34.810).

Table 12. Pearson Chi-Square Test

Attachment 1.	Value	df	Statistical significance (p)
Pearson Chi-Square Test Male	34.810	14	0.002

Source: Own calculations

One may say that the traditional meal experience is recognized as the main part of the national cultural heritage and 0also the ethnic identity of their people. By getting to know the food of a population, we get to know its habits and way of life. Food is the identitiy of the destination. According to some researchers, these characteristics represent a contractual zone of attracting tourists to a destination, and a powerful reason for the transformation of rural areas (Carvache-Franco et al., 2021). Looking at Table 13, we can conclude that the participants agree with the statement that food is a way to experience a traditional experience.

Table 13. Opinion of the participants

			Overall traditional meal experience			Total
			Like	Dislike	Neither	
Country of origin?	Serbia	Count	38	0	1	39
		% of Total	12,9%	,0%	,3%	13,2%
	B&H	Count	60	1	0	61
		% of Total	20,3%	,3%	,0%	20,7%
	Croatia	Count	24	0	0	24
		% of Total	8,1%	,0%	,0%	8,1%
	Macedonia	Count	7	0	0	7
		% of Total	2,4%	,0%	,0%	2,4%
	Montenegro	Count	37	0	0	37
		% of Total	12,5%	,0%	,0%	12,5%
	Slovenia	Count	79	0	0	79
		% of Total	26,8%	,0%	,0%	26,8%
	Greece	Count	25	0	0	25
		% of Total	8,5%	,0%	,0%	8,5%
	Hungary	Count	23	0	0	23
		% of Total	7,8%	,0%	,0%	7,8%
Total		Count	293	1	1	295
		% of Total	99,3%	,3%	,3%	100,0%

Source: Own calculations

Authors Mladenović and Bojičić (2018), showed in their work that people love traditional products and that they easily bond with certain brands which are the synonyms of quality, and by analyzing table 13, we conclude that participants in 99, 3% of cases agreed that 'salash' offers the unique, traditional experience, so there is no statistically significant difference here in participants' responses (p=10.429) depending on the country they come from.

Table 14. Pearson Chi-Square Test

Attachment 1.	Value	df	Statistical significance (p)
Pearson Chi-Square Test Male	10.429	14	0.730

Source: Own calculations

By analyzing tables 3, 5, 7, 9, and 15, we can conclude that the majority of tourists positively assessed the quality of service and food in the previously mentioned chardas and that this influences a positive attitude about the development of gastronomic tourism. Furthermore, this proves the hypothesis h4-the food and service in the restaurants represent the product which becomes the basis of tourist loyalty.

Table 15. Opinion of the participants

			Speed of service			Total
			Like	Dislike	Neither	
Country of origin	Serbia	Count	8	20	11	39
		% of Total	2,7%	6,8%	3,7%	13,2%
	B&H	Count	13	27	21	61
		% of Total	4,4%	9,2%	7,1%	20,7%
	Croatia	Count	12	11	1	24
		% of Total	4,1%	3,7%	,3%	8,1%
	Macedonia	Count	1	5	1	7
		% of Total	,3%	1,7%	,3%	2,4%
	Montenegro	Count	25	8	4	37
		% of Total	8,5%	2,7%	1,4%	12,5%
	Slovenia	Count	42	21	16	79
		% of Total	14,2%	7,1%	5,4%	26,8%
	Greece	Count	8	14	3	25
		% of Total	2,7%	4,7%	1,0%	8,5%
	Hungary	Count	6	11	6	23
		% of Total	2,0%	3,7%	2,0%	7,8%
Total		Count	115	117	63	295
		% of Total	39,0%	39,7%	21,4%	100,0%

Source: Own calculations

Table 16 does not show a statistically significant difference concerning participants' responses, since here is p=47.902

Table 16. Pearson Chi-Square Test

Attachment 1.	Value	df	Statistical significance (p)
Pearson Chi-Square Test Male	47.902	14	0.000

Source: Own calculations

It is stated for gastronomy that it might be the main reason a tourist chooses a destination (Santich, 2004), as well as the reason to stay longer at a certain destination (Kivela and Crotts, 2006). For Mak et al. (2012a) the destination is an attraction for restaurants.

Table 17. Opinion of the participants

			Attractiveness of surroundings		Total
			Like	Neither	
Country of origin?	Serbia	Count	35	4	39
		% of Total	11,9%	1,4%	13,2%
	B&H	Count	60	1	61
		% of Total	20,3%	,3%	20,7%
	Croatia	Count	24	0	24
		% of Total	8,1%	,0%	8,1%
	Macedonia	Count	7	0	7
		% of Total	2,4%	,0%	2,4%
	Montenegro	Count	36	1	37
		% of Total	12,2%	,3%	12,5%
	Slovenia	Count	77	2	79
		% of Total	26,1%	,7%	26,8%
	Greece	Count	21	4	25
		% of Total	7,1%	1,4%	8,5%
	Hungary	Count	23	0	23
		% of Total	7,8%	,0%	7,8%
Total		Count	283	12	295
		% of Total	95,9%	4,1%	100,0%

Source: Own calculations

Data from table 18 are similar to previous responses, so there is no statistically significant difference in participants' responses depending on the country they come from (p=16.815).

Table 18. Pearson Chi-Square Test

Attachment 1.	Value	df	Statistical significance (p)
Pearson Chi-Square Test Male	16.815	7	0.019

Source: Own calculations

Analyzing tables 13 and 17, we can conclude that the majority of tourists positively assessed the influence of the surroundings and the experience we get. This proves hypothesis h3-the environment that surrounds the Apatin chardas (national restaurants) is attractive and improves the overall impression (t 13, 17).

Based on the valorization, it is possible to notice that from all the chardas, only the Zlatna Kruna (Golden Crown) has the best grade for artistic value, thanks to the previously mentioned excellent parameters. Immediately after this charda, the Harčaš (Harchash) charda stands out. This charda has a special significance because of the beautifully landscaped environment in an attractive location near the Danube. After the Harchash Charda, the Kupusinksa Charda stands out for its specificity, it is ideal for all those who want to enjoy the silence and beauty of nature, and also who have the opportunity to spend the night, prepare food on their own, and drink coffee made in the old way.

Table 19. SWOT

STRENGTHS	WEAKNESSES
• Favorable geographic location • Good connection with surrounding places • Multiculturalism • A familiar attitude of citizens towards tourism • Great gastronomic offer • The existence of a tradition in the culture of hospitality • The long tradition of the event • The Danube river	• Poor infrastructure • Poor tourist markings and road signs • Insufficient cognizance • Lack of information • Lack of investment in tourism • Lack of additional tourist attractions • Lack of production and supply of souvenirs
OPPORTUNITIES	THREATS
• Promotion of new ways of tourism • Designing a new tourist offer • Improving marketing activities • Vacation segmentation into often and shorter stays at the new destination (another vacation) • Internet access • Local household interest for starting tourism	• Lack of investment in gastronomic tourism • Economic crisis • High unemployment rate and the emigration of the young and educated • Lack of funding sources for infrastructure and transport • The fast growth of competition • Losing position because of the competition

Source: Own calculations

Grades for the assessment of the gastronomy of the Apatin Chardas in tourism development, both with SWOT analysis (Table 19) and with valorization (Table 20) were:

VISION - At the very beginning of the development of this type of tourism, it is first necessary to determine the tour that tourists will make. This tour should contain a series of activities that will make time spent in Apatin beautiful and fulfilling to tourists. As people today more often decide on several brief vacations during the year, this weekend tour should attract tourists to visit the chardas as well as to improve the image of the destination itself. The tour would start from the charda "Zlatna kruna" (Golden Crown), where tourists would walk along the banks of the Danube and visit the Cathedral of the Holy Apostles, after which they would return to "Zlatna kruna" where hosts would offer them a fish stew and a roes pie.

After an afternoon meal and enjoyment along the banks of the Danube, tourists would choose whether to go by kayak with an instructor, for those who like to row alone, or by boat, for those who still prefer to feel the warm breeze on their faces. There they would be welcomed with an apéritif by their choice while listening to relaxing music of a good old tambourine. Here, tourists could enjoy some additional activities before dinner, such as cycling or, for fish lovers, fishing on the banks of the Danube and swimming in the river and for the youngest: games on the sand, skipping rope, badminton, playing marbles and other.

After enjoying additional activities, tourists could enjoy fish specialties for dinner, such as grilled fish, stuffed smoked carp; here tourists would spend the night under the starry sky in their tents to feel the true charm of nature. In the morning after breakfast, tourists

would go to the last charda - Kupusinska charda, by boat or bicycle for those who love cycling, where they would all take part in preparing fish stew, so to bring with them and pass on to new generations the famous Apatin recipe.

After the meal, a fishing competition would be organized for both the older and younger population, after which prizes would be given for the first three places that tourists will take themselves as a souvenir, and for the first place the prize would be a tour of the Upper Danube special nature reserve. It would encourage revisiting the destination and enabling the development of other types of tourism. Also, the reward for children would be sweets in their weight. After laughter and fun, tourists would return by boat to the original chard where their journey begins and ends.

MISSION – The mission of this form of tourism is primarily to expand the business of chardas and establish cooperation with all relevant entities of economic and social life that are important for strengthening tourism in the Municipality of Apatin, as well as for the planning of its positioning in the market. It is necessary to enable the connection of key stakeholders who will work together to form and implement this tourist product. It is necessary to enable the branding of this area as attractive for tourists and to provide support, through regular and project activities. Furthermore, it is necessary to establish constant information and marketing support, publish printed issues and create a website. The most important is the cooperation with the Tourist Organization of the city of Apatin, which will actively present this form of tourism as well as directly raise interest in tourists towards gastronomic tourism.

AIM- The primary goal of this form of tourism is to establish cooperation with the local population so that residents gain insight into the importance of this form of tourism. Through this form of tourism, it is possible to develop the local community and raise the standard of living. Furthermore, it would enable the creation of a recognizable image of the destination as well as attract a larger number of tourists, both domestic and foreign. The development of this type of gastronomic tourism will contribute to preserving the tradition and emphasize the potentials that this city has. It is very important to fulfill all the expectations of tourists, to fulfill their wishes and requirements, to create a positive image of this type of tourism, to influence the extension of tourists' stay and their return. It is necessary to introduce modern trends in the field of marketing and communication to become visible and recognizable in the market. Some of the other goals are also the infrastructural development of the destination and the ultimate goal is to ensure the long-term competitive advantage of the destination in the market.

Table 20. Valorization according to quantitative-qualitative methodology

	Resource accessibility	Tourist equipment	Surroundings	Resource specificity	Resource significance	Artistic value
Chard "Zlatna Kruna"	5	4.5	4.5	4	4.5	5
"Harčaš" Chard	4	4.5	5	5	4.5	4.5
"Kupusinska" chard	3	2.5	4	3.5	4	4

Source: Own calculations

Conclusion

The gastronomic offer of chardas represents a great potential for further development of tourism in the territory of the Municipality of Apatin. By developing this type of tourism, Apatin, as a tourist destination on the market, could offer a new product and attract new tourists. It is important to plan, in advance and with great care, the development of this type of tourism, to get the maximum benefit for all participants, as well as the tourists themselves. The development of this type of tourism would greatly contribute to the creation of the brand and recognition of Apatin as a tourist destination. Having all this in mind, we can conclude that the main hypothesis of the paper is proved.

Food is directly or indirectly related to Apatin, as a tourist destination; according to some authors, food encourages tourists to taste, and thus experience the local cuisine. In this paper, the lower level hypothesis h1 proved to be correct, just like the lower level hypothesis h4. For something to prove to be of high quality and thus have loyal consumers, it must, additionally, provide a certain satisfaction. This is exactly the triad of factors that affect loyalty: quality, satisfaction, loyalty.

Food and beverage are a powerful means of branding a country and means of its promotion. The involvement of food in tourism marketing and management has increased significantly in the last few decades. In some destinations, food is used as an eye-catcher in brochures, recordings, and television programs. In addition, the presentation of food takes place not only on the plates but also in the chardas. Apatin chardas have many gastronomic specialties that would lead to an increase in the number of guests (consumers) in this district, not only the production and preparation of dried meat products, pork scratching, soup, cooked meat, and tomato sauce but also the preparation and presentation of strudels, floating islands, and Bundt cakes. All this confirmed two hypotheses, h2 and h3.

Conflict of interests

The authors declare no conflict of interest.

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WILD EDIBLE PLANTS IN GOURMET OFFER OF ECOTOURISM DESTINATIONS: CASE FROM BIOSPHERE RESERVE „GOLIJA-STUDENICA"

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A R T I C L E I N F O	A B S T R A C T
	Closely related to traditional agriculture consumption of wild plants it significantly contributes to the existence of the human species. The aim of this paper is to determine the value of ethnobotanical parameters (RFC, CI, CV) for the most important species that participate in creating the gastronomic offer of ecotourism destinations. The research was conducted in the area of the Biosphere Reserve (BR) "Golija-Studenica" as one of the attractive ecotourism destinations and sites with a high degree of biodiversity. As part of the site visit and research, during the period 2018-2020, the authors used the ethnobotanical questionnaire to quantify and determine the value of each individual species that plays a role in local traditional gastronomy, and today is part of the tourist offer. The results indicate the existence of a culture of using natural resources and a high degree of use of wild species in traditional recipes. Among the most exploited species, wild berries like blueberries stand out, but some species of mushrooms.

Introduction

It is generally known that there are wild plant species that grow spontaneously and affect the self-sufficiency of a population that is independent of human actions. The use and consumption of wild edible plants is a phenomenon that preceded agriculture and appeared in ancient times and cultures (Guil et al., 1997; Ojelel et al., 2019). Their collection, consumption and sale significantly contribute to human existence and affect food safety.

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This study investigates the cultural significance in the diet of wild edible plants in the territory of the Republic of Serbia, with focus on BR „Golija-Studenica". Nature park Golija also includes the cultural wealth of the Studenica Monastery, which has been on the UNESCO World Heritage List since 1986 and is a very popular tourist attraction. Among all branches of industry, the tourism industry is considered the most sustainable in this region (Tomić & Stojsavljević, 2013), especially because tourism has a Win-Win effect on one economy (Pantić & Milojević, 2019).

As reported in research Burešova et al., (2020) gastronomy should be considered from the different points of view: historical and cultural aspect, creativity, available raw materials, methods and recipes especially aspects of local ingredients as basis of each diet, authenticity and unique taste. The same authors pointed out that gastronomy goes together with authentic environment shaped by climate and geographical features. The use of wild plants is an integral part of the traditional cultural system of the Golija area and the potential for creating economic value in agriculture, food production, human and animal nutrition. The potential of the gastronomic offer of BR "Golija-Studenica" as an ecotourism destination is processed by applying the Relative Frequency of Citation, Cultural significance index and Cultural importance index. The research showed that more than 26 species of wild edible plants were used in this area. The highest use value was found in berries, while most of the researched plants were used as tea, nectar or processed food. The most cited autochthonous wild plants are characterized by a high culture of consumption.

The hypothesis based on the facts that area of Golija mountain has significant natural potential (diversity of flora, climate, geographical features, ecotourism) as well as deep tradition, culture and knowledge of utilization of wild medicinal and aromatic species to present autochthonous products to tourists. This study intends to consider diversity of wild edible species in traditional gourmet offer with its use variety and cultural importance for this region. The novelty of this research refers to the first insight, on the small-scale, to highlight the most used species in food recipes, offered to the broader public, rather than its medicinal purpose as it was presented in previous studies.

Literature review

Edible wildlife products include a rich variety of plant forms and ethnobotanical characteristics ranging from grasses, shrubs and trees to mushrooms, algae and lichens. There are wild plants and other living organisms that are involved in the culture of human nutrition.

Wild plant species represent the unique importance of the biosphere that play a key role in cultural nutrition, providing direct and indirect resources for human consumption (Vinceti et al., 2013). Several authors, such as Powell et al., (2014) and Svanberg (2012), pointed out that wild food plays a significant role in the food system, especially when food insecurity is greatest, especially during dry or wet seasons.

The authors of Carvalho & Barata (2017) emphasized that wild edible plants especially serve as wild food for commercial and recreational purposes. In addition, this author emphasized the importance of wild plants for the sustainability of many rural areas. In addition, there are increasing examples of the availability of local wild herbs in local food markets. Pardo-De-Santayana et al., (2005) especially pointed out that when consuming wild edible plants in human nutrition, it is necessary to take into account social, economic and cultural factors. Based on these factors, traditional wild food was obtained, which represents an important segment in human nutrition. In addition to the fact that locally harvested wild edible plants participate in the human food chain, it also provides cash income for the indigenous population and plays a major role in ensuring global food security (Ju et al., 2013).

Blanco-Salas et al., (2019) concluded that wild plants have a high positive impact on sustainable rural development. Namely, according to the research of these authors, 145 species of wild plants on the Iberian Peninsula are useful for tourism and guiding consumers towards a high food culture, new gastronomy and environmentally friendly ways of food preparation.

There is a noticeable increase in the use of wild plants in protected areas that have the character of tourist hotspots. For example, several studies of the behavior and attitudes of tourists towards eating wild edible plants in these and similar areas have been conducted. The study by Wu et al., (2018) presents the results of a study conducted in China to examine the link between the consumption of wild edible plants and the tourist experience. According to the results, there is a great demand for these plants by tourists and locals due to tradition and the desire for green food. In addition, respondents perceive a low level of environmental responsibility despite the expressed environmental awareness. Similarly, Fuste-Forne (2019) used a case study to investigate the use of wild plants in forested parts of northeastern Spain. He established the deep role of this type of food in the culture and identity of local communities and the strong seasonal feature of tourist activities that has a direct impact on sustainable planning of forest capacities and tourism in rural areas.

When it comes to the natural resources of Golija, it should be noted that this area is a large source of drinking water, which has a dense network of about 500 springs, of which 250 are of good yield (Urošev, 2007). According to Grujičić-Tešić (2016), Golija has the densest watercourse network in Serbia of 2,100 m / km2, which is on average three times more than in other parts of Serbia. This network consists of 15 smaller and larger rivers, so it can be said that Golija is a large hydrographic hub of western Serbia.

Due to special values, a part of the Nature Park was inscribed on the list of MAB (Man and Biosphere) by the decision of the UNESCO commission in October 2001, under the name "Golija - Studenica" and allocated as a Biosphere Reserve (53,804 ha). It is the first proclaimed Biosphere Reserve in the Republic of Serbia (there are 727 of them in the world, according to UNESCO MaB program). The reserve includes the largest part of the Nature Park "Golija", its most important landscapes and landscape values,

natural rarities, together with the protected surroundings of the Studenica monastery. On the other hand, the richness of the Raška region in plant and animal species is a major tourist and ecological potential (Pavlović & Golić, 2011).

Authors Freytag & Vietze (2010) found a strong positive impact of biodiversity on the creation of a comparative advantage in tourism in poor and underdeveloped countries, which is more pronounced than in OECD countries. Here, the potential of sustainable tourism is seen in the absolute income from tourism per capita. Their creation is positively affected by the richness of biodiversity, while the negative impact lies in the eventual loss of the same.

Shaheen et al., (2017) used the significance of the cultural index (CSI) as a tool in their research, with the help of which they calculated the value of use (UV), which is a growing trend in quantitative research in this area in recent years. Also, in that sense, the relative frequency index (RFC) was used, which represents the result obtained by dividing the number of respondents who used a specific type with the total number of respondents. Similar to previous research, Ojelel et al., (2019) used the RFC index for each plant species separately as the ratio of subjects who used a particular species to the total number of subjects. By further descriptive statistical analyzes, the obtained values of these parameters were included in order to present and discuss the overall results. On the other hand, CSI can be used in various aspects of socio-cultural research, for example, Sutrisno et al., (2020) examined the preservation of ritual plants in the East Aceh region of Indonesia. The questionnaires included plant species, folk names, use and ritual tradition of this people. These sources were used as a methodological framework for this research.

Material and methodology

Study area

Mountain Golija belongs to the Dinaric mountain ark and as a part of *Stari Vlah-Raška* Mountain Range, it rises from the valley of the rivers Studenica, Brvenica and Moravica. Geographically Golija is located in south-west Serbia (43° 17′ 24″N; 20° 19′ 19″E), following west-east direction for about 32 km in the shape of Latin letter "S". Golija with surrounding mountains nestled in the vicinity of touristic centers of south-west and western Serbia (Novi Pazar-32km, Ivanjica- 40km, Raška-43km, Kraljevo-66km). According to exceptional natural values, the area of Mount Golija with associated mountains was proclaimed as a Nature Park "Golija" in 2002, as well as the Biosphere Reserve "Golija-Studenica", in the same year. This area comprises of coniferous, mixed coniferous-deciduous forests, pastures and meadows, but also of several water sources, streams and natural peat lakes. It is known that Golija possesses an imposing number of medicinal, aromatic and wild edible plants with a long historical tradition in use. In recent times this area becomes recognized as a favorable nature-based tourism destination with plenty of ecosystem services that the nature of Golija should offer. Besides outdoor activities, special attention is paid to local plant-based products and culinary specialties.

Data collection

Data was collected between 2018 and 2020 at the affirmed touristic sites of Golija Mountain. For this purpose were selected 2 villages (Rudno and Bzovik) with hamlets, at the territory of Rudno plateau (Radočelo mountain) within the boundaries of Biosphere Reserve, as well as the wider territory of villages Devići and Dajići on Golija mountain. Standard semi structured ethnobotanical questioner conducted on 54 respondents, mostly experienced elderly women and holders of touristic objects (ethno-lodge, ethno-apartments, and restaurants). The respondents were chosen "from door to door" with free will to be part of the survey. The ethnobotanical questioner composed of four parts: 1. Socio-demographic characteristics of respondents, 1. Wild edible plant species, 2. Plant utilization, and 3. Final plant-based product in gastronomic offer. According to the respondent's categorization of wild edible plant use in traditional cuisine, we formed 12 use categories: 1. Nectar (N), 2. Tea (T), 3. Processed food (PF), 4. Spices (S), 5. Rakia (R), 6. Liqueur (L), 7. Salads (S), 8. Jam (Jm), 9. Winer stores (WS), 10. Pies (P), 11. Cake (C) and 12. Bread/dough (B/D). Fieldwork includes as well as a collection of available plant material that was cited during the interviews. Plant species were determined using botanical literature (Josifović, ed. 1970-1978) and stored with vouchers in the herbarium of Gastronomic laboratory at the Faculty of Hotel management and tourism in Vrnjačka Banja.

Figure 1. Map of research area
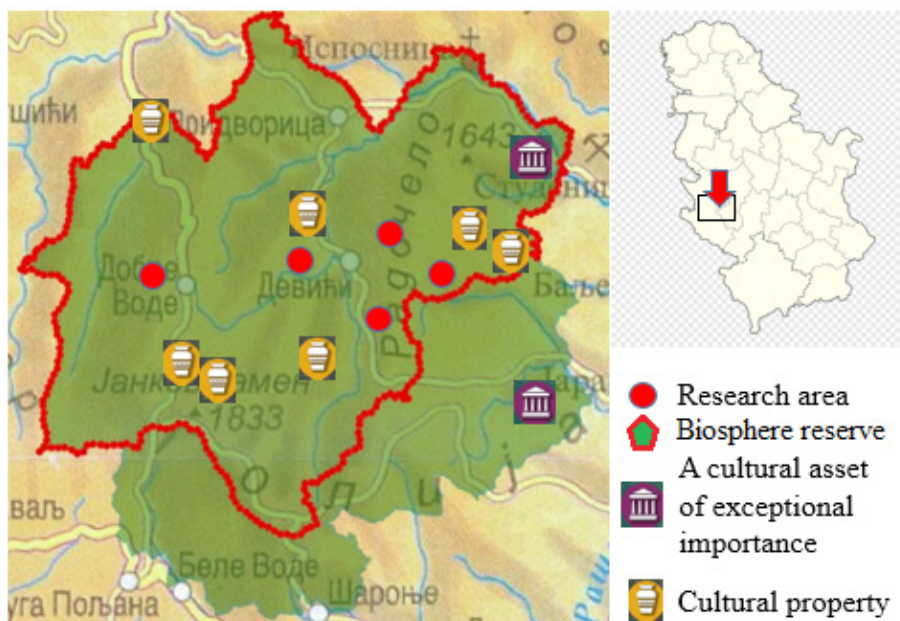
Source: Golija (Stari Vlah), available on: https://www.dinarskogorje.com/golija-stari-vlah. html, modified by authors

Data analysing

Collected ethnobotanical data were classified and stored in excel databases for further analysis. Ethnobotanical questioner analyzed based on several parameters: 1. The number of Use Reports (UR), 2. Relative Frequency of Citation (RFC), Use value (UV), Informants' consensus factor (FIC), Cultural Value Index (CV), Cultural Importance Index (CI). The method of the ethnobotanical questioner is well confirmed and widely used in the science of ethnobiology, ethnobotany, ethnomedicine and ethnofood (e.g. Tardío et al., 2008; Abbasi et al., 2013; Shaheen et al., 2017; Ojelel et al., 2019, ect.)

The number of Use Reports (UR) represents a combination of three parameters: 1. Respondents/informants "*i*", 2. cite the use of the plant species "*s*" in the determined use-category "*u*" (3.). This parameter is important for the cultural importance of plants.

$$UR_s = \sum_{u=u1}^{u\,NC} \sum_{i=i1}^{i\,N} URsui$$

-NS- species (s1, s2,..., sNS) with a total number of use categories NC (u1, u2,..., uNC)

-N informants (i1, i2,..., iN)

- UR_{sui} (0-1)

The Relative Frequency of Citation (RFC) index represents the number how many times one species is mentioned by respondents. This parameter does not consider the use category of plants and is determined for each species as the ratio of respondents who cited a species to the total number of respondents.

$$RFC = \frac{FC}{N}$$

Where FC is frequency of citation and N is total number of respondents.

The Use value (UV) demonstrates the relative importance of plants known locally.

$$\{UV = \sum U_i / N\},$$

where U_i is the number of uses mentioned by each informant for a given species and N is the total number of informants (Appiah et al. 2017).

Cultural importance index (CI)- takes into account not only the spread of the use (N- number of informants) for each species but also the diversity of its uses. The theoretical maximum value of the index is the total number of different use-categories (NC) and defined by the following formula:

$$CI_S = \sum_{U=U_1}^{U_{NC}} \sum_{i=i_1}^{i_N} UR_{ui} / N$$

Cultural Value Index (CV) designed by Reyes-García et al. (2006) represented with equation:

$$CV_s = \left[NU_s \Big/ NC \right] \times \left[FC_s \Big/ N \right] \times \left[\sum_{U=U_1}^{U_{NC}} \sum_{i=i_1}^{i_N} UR_{ui} \Big/ N \right]$$

Where NU_s is number of different uses reported for the each species; NC- total number of use-categories considered in the study

Pearson Correlation Coefficient was used as a good measure to quantify the nature of the linear relationship between variables numerically, in our case, to check the relationship between the ethnobotanical indices (UV and RFC, RFC and CI, etc.). It is the covariance ratio between two variables to their standard deviations (Appiah et al. 2017).

The final set of results presented tabular and using bar charts.

Results and discussion

Socio-demografic characteristics of respondents

The results report that 78% of all respondents were females, while 22% were males (Table 1). Traditionally and culturally females make the core of the population in terms of wild edible resources utilization or natural products produced in different countries, cultures, or ethnic groups around the globe what confirmed the number of studies (e.g. Yeşil et al., 2019). Voeks (2007) and Howard (2003) highlighted women as queens of plant resources, keepers of culture and tradition and they accent the role of females in natural products collection. The questioner included mostly the population of elders, especially experienced women (68.2%), then middle age population (24.07%) and only four young people what makes (7.41%). Considering education level, no-educated or primary school level educated people (50%) together with secondary school level (42.59%) of total respondents, makeover the 92% interviewed population. In terms of economic status, 62.96% of respondents have an average income, less than average 18.52% same as over average income. A local economy based on agriculture primarily with 94.44%, followed by wild natural products collection 38.9% and tourism with 27.8%. Natural resources utilization reserved for the female population implicate that these activities bring a significant contribution to total household income. Following similar ethnobotanical studies (e.g. Reyes-García et al., 2008; Tardío et al., 2008; Shaheen et al., 2017, etc.) demographic parameters (gender and age) and socio-economic parameters (education level, economic status and economic activity) show that wild plant resources utilized in rural areas by elder people with traditional knowledge, by a lower level of education and with under average economic status. Wild edible plants represent the additional activity to agriculture and tourism.

Table 1. Socio-demographic characteristic

Variable	Category	Number of informants N=54	Percentages (%)
Gender	Female	42	78%
	Male	12	22%
Age	18–30	4	7.41%
	31–50	13	24.07%
	>50	37	68.2%
Education	No-education/Primary	27	50%
	Secondary	23	42.59%
	University	4	7.41%
Economy	<of average	10	18.52%
	average	34	62.96%
	>average	10	18.52%
Monthly income based on…	Agriculture	51	94.44%
	Tourism	15	27.8%
	Wild products collection	21	38.9%

Diversity and local impotrance of wild edible plants in the Biosphere Reserve „Golija-Studenica"

According to ethnobotanical interweaves was mentioned 52 plant species which could be used as food. Of that total number of species, we extracted 26 with relative frequency citation (RFC) more than 0.3 (Table 2) to calculate other important parameters. Dataset is divided into 12 categories related to food. Results show that the highest cultural importance index (CI) have *Vaccinium myrtilis* (blueberry), *Boletus spp.* (porcini mushrooms), *Mentha spp.* (mint), *Thymus serpyllus* (thyme), *Cantharesllus cibarius* (chanterelle). All highlighted wild edible species has important economic value research areas and represent one of the significant sources of income what was the potential reason to be mentioned. In the list of the first ten also were mentioned traditional wild edible species such as *Rubus fruticosus* (blackberry), *Fragaria vesca* (wild strawberry), *Urtica diorica* (nettle), *Lactarius piperatus* (peppery milkcap), *Origanum vulgare* (oregano), also with high economic potential.

Pearson correlation was calculated for the important valiables, between RFC and UV, RFC and CI, UR and CI. All tested variables show positive correlation value. The results for UR-CI (r= 0.999) show almost maximal value of positive correlation, as well as for RFC-CI (r=0.942) and RFC-UV (r=0.748). If number of respondents or citation for particular species increase, the use value or cultural index also increase.

Table 2. Selected most frequently mentioned wild edible species by informants (UR- Use Reports, RFC – Relative frequency of citation, UV – the use-value, CV- Cultural Value Index, CI- Cultural importance index

Abb.	Species	UR	FC	RFC	NU	UV	CI	CV	Ranking		
									RFC	CI	CV
JC	*Juniperus communis-* juniper	42	32	0.59	7	1.61	0.78	0.27	14	11	7
BP	*Betula pendula-*birch	24	18	0.33	2	0.46	0.44	0.02	26	24	26
UD	*Urtica diorica-*nettle	48	32	0.59	5	1.70	0.89	0.22	13	8	10
R	*Rumex* spp.-greens	40	33	0.61	4	0.94	0.74	0.15	12	14	14
RF	*Rubus fruticosus-* blackberry	49	35	0.65	7	1.67	0.91	0.34	10	6	3
RI	*Rubus ideus-*raspberry	37	28	0.52	5	1.52	0.69	0.15	17	16	13
FV	*Fragaria vesca-*wild strawberry	48	37	0.69	5	1.80	0.89	0.25	9	7	9
RC	*Rosa canina-* pomegranate	42	39	0.72	3	1.28	0.78	0.14	6	12	15
CM	*Crategus monogina-* haw	27	20	0.37	2	0.39	0.50	0.03	24	22	23
PS	*Prunus spinosa-* blackthorn	29	22	0.41	4	0.65	0.54	0.07	22	20	19
CMas	*Cornus mas-* cornel	30	29	0.54	5	1.06	0.56	0.12	18	19	16
MO	*Melissa officinalis-* lemon grass	35	31	0.57	4	0.93	0.65	0.12	16	18	17
OV	*Origanum vulgare-* oregano	44	37	0.69	4	1.54	0.81	0.19	8	10	11
TS	*Thymus serpyllus-* Thyme	54	40	0.74	4	1.52	1.00	0.25	5	4	8
M	*Mentha* sp.- Mint	58	41	0.76	6	1.63	1.07	0.41	4	3	2
TO	*Taraxacum offinicale-* dendalion	36	28	0.52	4	0.43	0.67	0.12	19	17	18
TM	*Teucrium montanum-* mountain germander	24	23	0.43	3	0.69	0.44	0.05	21	25	20
AU	*Allium ursinum-* wild garlic	41	34	0.63	7	1.50	0.76	0.28	11	13	6
VM	*Vaccinium myrtilis-* blueberry	62	47	0.87	7	1.83	1.15	0.58	1	1	1
ME	*Morchella esculenta-* common morel	25	19	0.35	3	0.44	0.46	0.04	25	23	24
CC	*Cantharellus cibarius-* chanterelles	50	43	0.80	5	1.15	0.93	0.31	3	5	4
AC	*Agaricus campestris-* field mushroom	28	25	0.46	2	0.48	0.52	0.04	20	21	22
LP	*Lactarius piperatus-* pepper milkcap	47	38	0.70	1	0.70	0.87	0.05	7	9	21
LS	*Laetiporus sulphureus-* chicken-of-the-woods	23	22	0.41	2	0.46	0.43	0.03	23	26	25
B	*Boletus* spp.- porcini mushrooms	55	45	0.83	4	1.50	1.02	0.28	2	2	5
MP	*Macrolepiota procera-* parasol mushroom	39	32	0.59	3	0.70	0.72	0.18	15	15	12

Nature provides a broad specter of wild edible species for local people in terms of medicinal plants, applicative use in daily work, or supplementing nutrition (Delang, 2006). Western Balkan countries were subject of interest in different studies, especially were analyzed medicinal plants in traditional healing (e.g. Menković et al., 2011; Šavikin et al., 2013) but also wild edible plants (e.g. Pieroni & Quave, 2014) where highlighted mountain plants such as *Origanum vulgare*, *Rumex patientia*, *Urtica dioica* and *Vaccinium myrtillus* as culturally, economic and gastronomy important species. Biosphere reserve "Golija-Studenica" represent one of the important biodiversity areas with more than 900 described plant species (including mushrooms) and with 20% of medicinal, aromatic or edible species (Gajić, 1984). Wild natural resources (both plants and mushrooms) play a historical role in the culture, medicine and nutrition of researched area. It is known that the first records of medicinal plant use were related to the monastery of Studenica (Dajić Stevanović et al., 2015). In the past and present, plant utilization finding a role in rituals (e.g. oak or spruce trees as "zapis"- sacred tree, *Ocimum basilicum*- basil) or in traditional medicine for humans and animals. The most believed species, beside garlic, is *Teucrium montanum*- mountain germander for which valid "rising from the dead" (Luković & Nićiforović, 2021). In recent times many species become part of the local gastronomic offers in eco touristic destinations such as Golija mountain. Housewives in this region daily use about 20 plant/mushroom species as a spice, for bread, for cooked food. One of the most recognizable products is so-called "green bread" with about 10 aromatic plants.

According to a report on wild medicinal and aromatic plants for Balkan countries (Traffic, 2021), the most collected plant species in previous years include species from our results. That fact confirmed an economic value of these species and therefore its cultural importance and frequency of citation.

If consdidered biological categories of selected wild edible species, it is obvious that trees/shrubs and wild berries together make 38.46% as leading natural products in gastronomic offer. Herbs make 34.6% of the total species, followed by mushrooms with 26.92% (Figure 2).

Figure 2. Grouped plant species in biological categories

■ Berries ■ Herbs ■ Trees/shrubs ■ Mashrooms
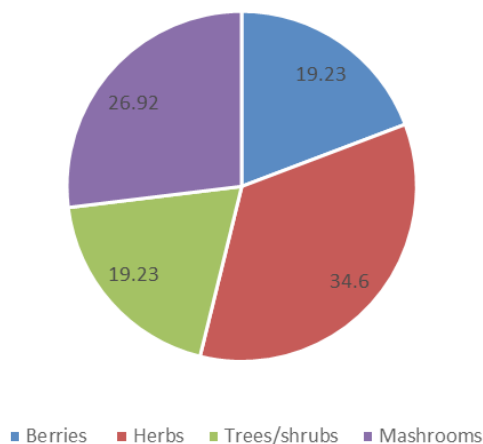
In to emphasize plants and their wide range of use we create a relationship between the number of specific categories (NU) in which wild edible species are mentioned and the number of respondents (FC) who cited particular species (Figure 3). This figure shows that only a small number of species has limited utilization in two categories. The number of wild edible plants used in different gastronomic products. The interesting fact is that wild berries found a way to be utilized in most of use-categories as nectar, jam, liqueur, cakes, as well as processed in cooked food. Mushroom have a high value of citation, but limited on processed food or specific products.

Figure 3. Relationship between the number of use-categories for each species (NU) and frequency of citation (FC).
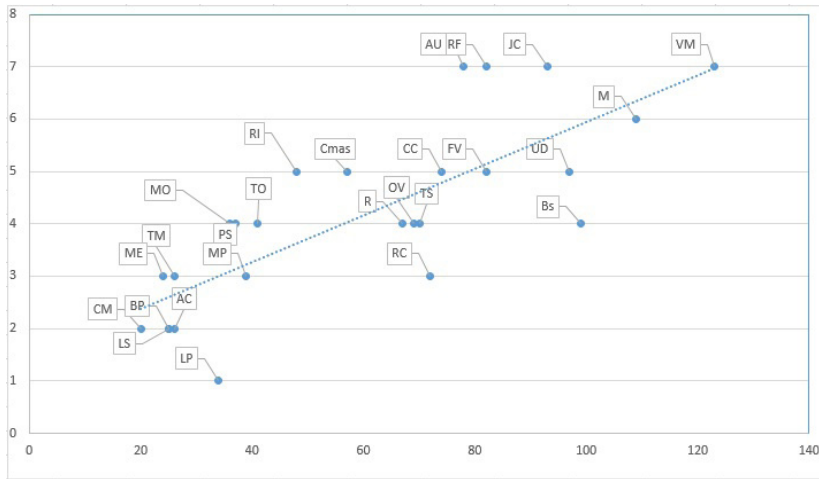
*Note:* Abbreviations represent initials of species, see table 2.

Wild edible plants in different gourmet categories

Wild edible species were classified into 12 categories: 1. Nectar (N), 2. Tea (T), 3. Processed food (PF), 4. Spices (S), 5. Rakia (R), 6. Liqueur (L), 7. Salads (S), 8. Jam (Jm), 9. Winer stores (WS), 10. Pies (P), 11. Cake (C) and 12. Bread/dough (B/D). The table 3 presented the number of species-specific to each category and use reports for each species in each category. The highest value of use report recorded to the category of tea (T) with 20.03% of all analyzed use-categories. This result was followed by nectar (N)-*17.71%* and processed food (PF)- 14.36%. In correlation to the high percentage of herbs participation (34.6%), it is the logical to trace the number of medicinal plants (*Thymus serpyllus*, *Mentha spp., Teucrium montanum*, etc.). Although the category of bread/dough (B/D) is in the group of plants with the least percentages (3.35%) the novelty and core of touristic attraction make spicy or green species. Also, one of the novelties is report on mushrooms utilization in the jam (Jm) category. This kind of food is not recorded in previous studies and possibly represents the impact of modern gastronomy.

Table 3. Number of use reports(UR) and species in use-categories

Category	No. Of species	%age	UR	%age
N	12	46.2	223	14.36
T	17	65.4	311	20.03
PF	12	46.2	275	17.71
S	10	38.5	142	9.14
R	6	23.1	43	2.77
L	8	30.8	53	3.41
S	7	26.9	72	4.64
Jm	9	34.6	165	10.62
WS	4	15.4	56	3.61
P	7	26.9	100	6.44
C	6	23.1	61	3.93
B/D	10	38.5	52	3.35
Total			1553	100
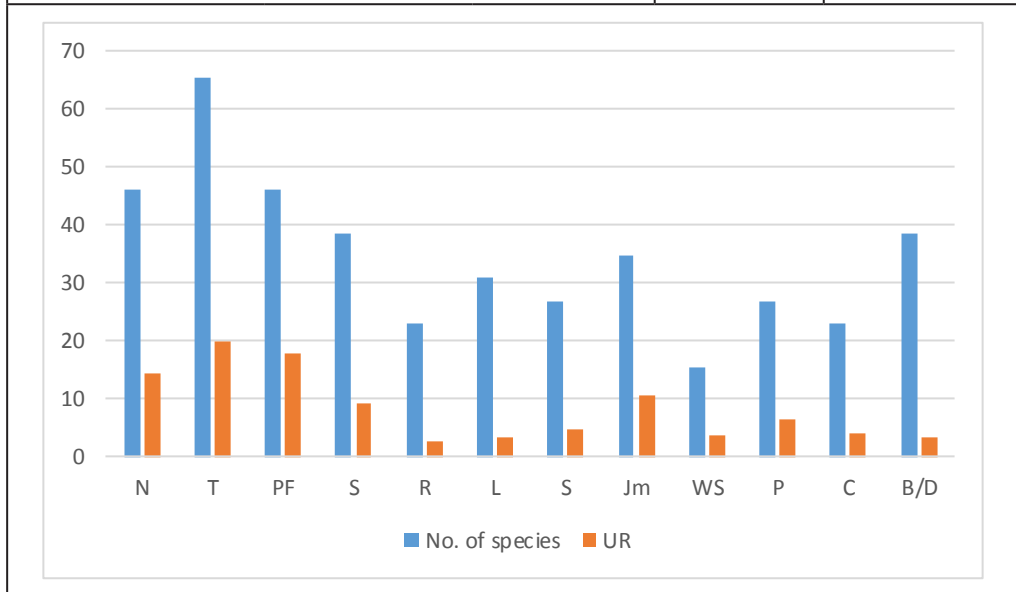
Note: 1. Nectar (N), 2. Tea (T), 3. Processed food (PF), 4. Spices (S), 5. Rakia (R), 6. Liqueur (L), 7. Salads (S), 8. Jam (Jm), 9. Winer stores (WS), 10. Pies (P), 11. Cake (C) and 12. Bread/ dough (B/D), Use report (UR)

Wild edible plants have long culture and tradition in Europe with several hundred species in use (Guarrera, 2003). South Europe with Balkan countries are recognized in numerous studies as an ethnobotanical worth region with exceptional plant diversity. Compare to other countries, Serbia has recorded 300 wild edible plants (Vračarić, 1977). Centers of plant diversity as well as centers of wild natural product use are mountain regions. There is a data according to Bonet & Valles (2002) that region of Biosphere Reserve Montseny has 132 edible species and about 30% is in use, compared to our studies much less. Similar to our research, in Bosnia and Herzegovina (Jaman Redzic, 2006) show specter of wild edible

plants use-categories from fresh salads, cooked food, beverages to ethnomedicinal purpose. They also emphasize the importance of *Crataegus monogyna, Cornus mas, Urtica dioica, Melissa officinalis, Mentha sp., Taraxacum officinale* in local nutrition. As reported in the study of wild edible fruits (Popović et al., 2020) berries are the most preferred group of wild edible plants for different use categories (fresh, medicinal purpose, jam, marmalade, alcoholic and non-alcoholic beverages) because of taste characteristics.

Conclusion

This study represents a report on ethnobotanical data in the gastronomic sector in selected ecotouristic destination BR "Golija-Studenica". The study analyzed several ethnobotanical parameters (RFC, CI, CV). According to results cultural importance and value show 26 wild edible species including wild berries, herbs and mushrooms. The highest value of diversity of utilization was found in berries, while most of cited plants were used as tea, nectar and processed food. Following all categories, *Vaccinium myrtilis* play a significant role in local gastronomy with the highest values of RFC, CI and CV. Respondents mostly cited plants with economic importance and which ones who represented potential addition to income, but also one who has potential to attract tourists. The limitation of this study was due to not considering the economic and practical value of wild edible plants. These ethnobotanical parameters are tasks for further researach.

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Conflict of interests

The authors declare no conflict of interest.

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ECONOMIC ANALYSIS OF THE FACTORS INFLUENCING THE SUPPLY AND DEMAND OF RASPBERRY

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A R T I C L E   I N F O

A B S T R A C T

The subject of this research is the analysis of supply and demand of raspberries on the domestic market in order to perform a balance analysis of products and examine the partial influence of relevant factors on supply and demand. The production and consumption of raspberries in Serbia in the period from 2010-2019 is very dynamic. Raspberry production in the Republic of Serbia has significant comparative advantages compared to production in most other countries. Serbia is considered one of the largest producers of raspberries, but still, regardless of that, its comparative advantages have not been fully valorized and used. The results of the balance analysis of raspberry production and consumption indicate the existence of a surplus and potential for export. The analysis of ANOVA variances established a high correlation dependence and pointed out the need to improve competitiveness in the production of raspberries and final products in order to meet the domestic market and exports to the world market. The obtained results enabled the formulation of regression equations of both the function of raspberry supply and its demand, which can be used to predict these values in the future.

Introduction

Supply and demand are the two most commonly used terms and represents the forces that enable the functioning of market economies. They determine the quantity and price of each produced good. (Mankiw, 2008; Mankiw & Taylor, 2008). In the effort to more

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precisely define the concept of supply, it is important to emphasize that supply is the final stage of the production process in the market economy (Stanković, 2020; Jokić, 2020). The quantity of goods or services offered by producers on the market depends on the price of that good or service, the price of other goods or services, the income of consumers and other factors (Babić, 2004). Thus, the supply represents the quantity of goods or services produced by the entrepreneur, in order to be sold on the market, at the price formed in accordance with the specific conditions of the functioning of the market mechanism (Đorđević, 2006). According to the law of supply on the market, there is a direct positive correlation between price and supply. The total sum of individual offers of producers on the market represents the global or aggregate offer of a product on the market, the sum of offers of individual companies at a certain price (Babić, 2004).

In market theory, ie in the study of market laws, the central place is occupied by the analysis of market demand (Porter, 1990). Demand is considered to be the main driver of economic activity, reproductive and investment consumption. Production activities are accompanied by consumption, which is defined as the quantity of goods that can be sold at any price in a certain market at a certain time (Babić, 2004). The movement of individual demand is largely conditioned by the price level. That is why is said that demand in the narrower sense of the word is a function of the price of that good (Babić, 2004).

Speaking of markets and making individual and total profits, it is important to point out the existence of many factors, both economic and non-economic. The most important factor which affects on the realization of profit is certainly the structure, ie the characteristics of the market. Numerous factors can affect the market position of the any company (Đorđević, 2008). Samuelson emphasized the great importance that in the mass of products, for a successful market competition, it is crucial that the product must be different, even in one segment from others (Đordjevic, 2008).

Analyzing the market organization of the agricultural products in Serbia, there would be no encouraging data (Šapić et al, 2018; Filipović & Šapić, 2020; Đorđević & Mitić, 2020). Namely, it is much more disorganized than, not only in Europe, but also in the surrounding countries.The raspberry market in Serbia has the characteristics of a perfectly competitive market on the supply side and the characteristics of ologopol on the demand side. In the raspberry market, there is a disorganization of purchases, producers and processors.

In order to valorize the comparative advantages in the production of raspberries, which Serbia has at its disposal, a more active role of the state is needed (Pejanović, 2007). First of all, the state should stimulate producers to expand their plantations as well as the production of processed products with purchase prices (Božidarević, 2002; Hanić, 1990; Hanić, 2005). This is exactly the type of product whose sale on the global market can make an additional profit for the benefit of the entire economy. Manufacturers must not be left in the belief that they are left to fend for themselves, which is indeed sometimes the case (Samuelson, 2007; Jurin & Šohinger, 1990). The dissatisfied producer is then constantly questioning whether to continue production. In many cases,

the production of raspberries in Serbia is a family and traditional business that is passed from one generation to another, which would make the damage from the cessation of this activity many times greater (Bodiroga & Sredojević, 2017; Temelkov, 2020). This is not what any society wants, sending very bad message to the future generations who are full of enthusiasm but also experientially acquired knowledges.

Literature review

Wróblewska et al. (2019) dealt with the analysis of raspberry production and comparative analysis on the example of Serbia, Poland and Ukraine. The results showed that Ukraine is a growing power in raspberry production. The offer has multiplied in recent years, which has strengthened Ukraine's export potential and thus its positioning on the world market. The results of exceptional price competitiveness of production in Ukraine are in extremely low production costs, which leaves room for producers to calculate their prices without neglecting to make a profit on the one hand, but also a competitive price that gives an advantage on the global market.

Radosavljević (2016) dealt with the problem of raspberry production in small production farms and the efficiency of using resources in order to make production, and thus the price, competitive on the market. Also, she came to the conclusion that Serbia did not use its comparative advantages in raspberry production due to inadequate financing policy due to which there was no significant growth of the field under raspberries. This is one of the reasons for insufficient price competitiveness and inadequate supply as it can be, having in mind the comparative advantages that Serbia has at its disposal.

Paraušić & Simeunović (2016) dealt with the issue of weaknesses and strengths of raspberry producers in Serbia. Among other things, they pointed out that Serbian raspberry producers have one of the leading positions on the global raspberry market. In order to maintain that position, it is necessary for raspberry producers to achieve better communication, which can only help in the unified position of all producers, ie the offer of raspberries in Serbia. They emphasized the growing importance of marketing activities, which is one of the most important elements of successful market positioning in modern business.

Bojkovska et al (2020) dealt with the analysis of raspberry production in Northern Macedonia as well as the possibilities of its improvement. In addition, they also analyzed the global raspberry market, and stated that Russia is the leader in its production, while Mexico and the Republic of Serbia are slightly behind. These three countries produce almost 50% of the total world production of raspberries. The growth of world production is never higher because each year is a double-digit percentage growth. They believe that Northern Macedonia should follow the examples of good practice of the surrounding countries and use its potentials, which certainly has. Also, the demand for raspberries in Northern Macedonia is much higher than its supply, which results in extremely high prices that are not competitive on the global market what makes export almost impossible. They said that the export of raw raspberries is not a chance that Northern Macedonia has, but all

potentials must be focused on the export of processed raspberries and products that can be offered on the world market. Thus, they emphasized the importance of the multiplied income that will come to the country through exports.

Farnsworth et al. (2017) performed analysis and market position of organic raspberry producers. The fact is that organic products are more expensive and more difficult to access for the average customer than those that cannot be considered organic. Nevertheless, the unsaturation of the market with organic products gives room for better positioning and making higher profits. As a rule, the demand for organic products is lower, but once customers decide to buy these products, they stay for a long period of time. That is why the demand for these products is more constant and customers are more loyal and long-term. For these reasons, it is important to position supply in markets where demand bearers are richer, ie in developed markets.

Apáti (2014) analyzed the position and perspective of raspberry producers in Hungary. The results he obtained indicates drastic decline in its production. He notes that there has been a multiple decline in the area of raspberry plantations, which he considers a consequence of inadequate cost policy. The costs of raspberry production in Hungary are extremely high, which does not allow for adequate market positioning and its sale even on the domestic market. The reason is the extremely price-competitive raspberry from imports, primarily from Serbia, which is also of much better quality. It also points to an insufficiently trained and interested workforce. He also believes that the state must accelerate the production of raspberries with its measures in order for the offer to be adequate and competitive not only on the domestic but also on the foreign market.

Milić et al. (2017) analyzed the production of raspberries in Serbia, but also its export to the global market. They noticed that the producers are increasingly oriented towards the modern way of production as much as they can in their financial power. Exports are growing and the share of total production, which is intended for the domestic market, is decreasing, and a lack is often noticed and the need for even higher production is shown. Also, raspberry growers are increasingly noticing the importance of marketing activities that are considered a necessity rather than a choice in the modern business environment. If we look at the demand side, it is noticeable that customers are increasingly oriented to well-known brands that, in addition to quality, are built with adequate and constantly present marketing activities. For that reason, the realization of the profit of a modern producer is conditioned by the increasing expenses that are necessary to invest in the entire production process. Smaller producers may initially have difficulties for this reason due to the lack of initial capital.

Materials and methods

The subject of the research is the analysis of supply and demand of raspberries on the domestic market, with the aim of performing a balance analysis of products and examining the partial influence of relevant factors on supply and demand. The paper analyzes the production and consumption of raspberries in Serbia in the period 2010-

2019. A balance sheet analysis was performed based on time periods lasting three years. Correlation analysis was used to obtain the desired results and set goals. The offer of raspberries was considered, ie the effect of prices, consumption and imports on it. In addition, the demand for raspberries was also considered, ie how price, GDP and exports affect it.

The qualitative - quantitative research method is applied in the paper. For the purposes of the analysis, data in the period 2010-2019 from Statistical Office of the Republic of Serbia but also many other sources which will be listed below.

The influence of relevant factors on the supply and demand for raspberries was considered by multiple linear correlation analysis. The multiple linear equation can be represented as (Kiš, 2005):

$$Y= a+b_1x_1+b_2x_2+b_3x_3+......+ b_nx_n, R, Sy, r_1, r_2....r_n,$$

The presence of correlation and its probability was confirmed by analysis of variance (ANOVA). Also were exmined the influence and significance of each coefficient by T-test. The value of the partial correlation was also determined.

Results

The paper discusses the production and consumption of raspberries. In order to achieve the set goals and expected results, were used available datas, which were grouped into time frames lasting 3 years, which were then the subject of correlation analysis. In our conditions, the production and supply of agri-food products (which includes raspberries) are relatively unstable economic and market categories. Consumption has a low coefficient of elasticity, which is why the demand, ie market consumption of these products is a relatively stable market category (Đorović & Tomin, 2010).

The balance analysis examined the realistically available production and consumption and determined the balance surplus or deficit of raspberries. Based on the surplus and deficit, conclusions were clearly drawn about the possibility of its export.

In the examination of the influence of individual factors, were considered all relevant factors which affects on production and consumption of raspberries In that manner, the comprehensive balance sheet analysis responded to the goal of the paper, to look at the available balance quantities for exports and the factors that affect production and available consumption. At the same time, based on the balance of production, consumption and foreign trade of raspberries, the impact of certain categories on supply and demand was analytically measured. (Babović, 2009).

The total available production of raspberries in the ten-year period is the production in the amount of 98.54 thousand tons. Total consumption of raspberries on the domestic market in the period 2010-2019 is an average of 23.92 thousand tons. The balance difference between the total available production and consumption is the available quantities for export in the amount of 74.62 thousand tons.

Raspberry is a Serbian brand. The raspberry fruit is of high quality and there is a permanent demand for it on the foreign market. Therefore, it is necessary to invest in raising raspberry plantations and programmatically organize the production and export of raspberries. Raspberry production in 2019 is on larger areas compared to the previous year, so export is expected to increase.

Table 1. Balance of production and consumption of raspberries in Serbia in thousands of tons

Category	2010.	Ø10-12	Ø13-15	Ø16-18	2019.	index 13-15/10-12	index 16-18/13-15	index 19/10
Initial stocks	0	5,5	1,69	0	0	30,73	-	-
domestic production	61,6	92,4	110,89	104,23	113,1	120,01	93,99	183,60
Total quantities available	**61,6**	**97,9**	**112,58**	**104,23**	**113,1**	**150,73**	**93,99**	**183,6**
Final stocks	0	1,1	1,69	0	0	10,22	-	-
Total domestic consumption	21,89	17,6	17,29	23,16	26	98,24	133,95	118,78
Total consumption	21,89	18,7	18,98	23,16	26	108,4586	133,95	118,78
surplus	39,71	79,2	93,6	81,07	87,1			

Source: RZS and author's calculation

The balance analysis shows that the total available raspberry production in 2019 compared to 2010 increased by 87.1%. In the ten-year period, the yield was increased, and considering the larger areas under raspberries, the supply and the possibility of export were also increased. Total consumption in 2019 increased by 18.78% compared to 2010.

The balance surplus of raspberries was on average of 74.62.14 thousand tons in the analyzed period. Available natural resources and balance analysis shows that Serbia, with an adequate economic policy, can be a leading and permanent exporter of raspberries and its products. It is necessary to invest in the development of raspberry processing in a set of final products in order to increase profits. Namely, a wide range of various products is now produced in the world on the basis of raspberries.

In 2019 was achieved a higher yield and a further increase in raspberry exports. Long-term exports must be programmed by investing in plantations and processing. In addition to the export of fresh and frozen raspberries on the supply side in the world there are lyophilized raspberries, dried raspberries, candied raspberries and dried raspberries in various ways. We offer wines, brandies and raspberry vinegar, syrup, canned raspberries without seeds, jam, jam, dried ground seeds, jelly products and various pastes and creams, etc. Orientation should be on the processing of raspberries into a highly final assortment in order to achieve multiple profits in relation to the export of raw and frozen raspberries. Adequate program organization of production and processing and stimulating agricultural policy, given the quality, quantity and price

competitiveness, should encourage the development of this production for permanent and profitable and anticipated export to the world market.

The balance analysis considered the production, consumption and foreign trade of raspberries in Serbia in the period 2010-2019. years. The balance analysis examined the realistically available production and consumption and showed the foreign trade turnover.

The research examined the influence of domestic production, imports and purchase prices on the supply of raspberries. Correlation analysis examined the impact of domestic production X1, imports X2 and purchase prices X3 on raspberry supply U. At the same time, correlation analysis examined the impact of domestic consumption X1, loss X2, exports X3, sales price X4 and income X5 on total raspberry demand.

Table 2. Influence of factors on the supply and marketing of raspberries

Function		Production		Import	redemption price	
Supply	**R**	**r1**	**r2**	**r3**	**r4**	
$Y = -23{,}56 + 1{,}342X_1 - 4{,}898X_2 - 0{,}000035\ X_3$	0,943	0,824		0,02	☐ 0,22	-
Demand		Domestic consumption	Sales prices	Income	export	Final stocks
$Y = 39{,}19 + 0{,}55X_1 - 2{,}165X_2 - 0{,}304X_3 + 0{,}000063X_4 - 0{,}25X_5$	0,975	0,727	0,09	-0,613	0,399	0,105

Source: Author's calculation

The data from Table 2 show that the influence of prices, production and import on the change in the supply of raspberries is in the amount of 94.3%.. When offering raspberries, there is a positive and a negative correlation of factors. Domestic production has a positive impact on supply. The increase in production will increase the supply by 1.34 thousand tons. Changes in imports and purchase prices negatively affect the supply of raspberries.

The next step is to determine the probability of a correlation. The value of F is 13.28, which is significantly more than the required value, so it can be said that the created regression equation is valid and has an acceptable statistical significance in the supply prediction.

In order to obtain the desired results, a T-test was used to examine the influence of all coefficients on the supply of raspberries. The obtained results were compared with the critical value t ($\alpha = 0.05$) and all were statistically significant and important for the purpose of formulating the regression equation on the supply side.

The analysis of the correlation of domestic production and supply of raspberries gave the value of 0.92, which shows that there is a very high correlation. The value of the correlation between the import and supply of raspberries is 0.02, which shows that there is a minimal correlation.

After defining the equation on the supply side, an identical analysis was performed on the demand side. The data from Table 2 shows that the impact of consumption, loss, export and prices on the change in demand for raspberries is 97.5%. When looking for raspberries, there is both a positive and a negative correlation of factors. Consumption has, for example, a positive effect, while loss and exports have a very negative impact on the demand for raspberries.

The next step is to determine the probability of a correlation. The value of F is 11.63, which is significantly more than the required value, so it can be said that the created regression equation is valid and has an acceptable statistical significance in predicting the demand for raspberries.

In order to obtain the desired results, a T-test was used to examine the influence of all coefficients on the supply of raspberries. The obtained results were compared with the critical value t ($\alpha = 0.05$) and all were statistically significant and important for the purpose of formulating the regression equation on the demand side.

Analyzed correlation between domestic consumption and total demand for raspberries the gave coefficient of 0.55 which shows the average correlation dependence. Value of the correlation between export, sale price, income and total demand shows the minimal negative correlation between the examined phenomena.

Conclusion

Supply and demand are two basic principles and represent the driving forces of the functioning of market economies. They determine the quantity of products that are produced and the price at which they are sold. It was confirmed that there is a direct positive correlation between price and supply on the market. In the study of market laws, the central place is occupied by the analysis of market demand. The market in Serbia has the characteristics of a perfectly competitive market on the supply side and the characteristics of ologopol on the demand side. There is a disorganization of purchases, producers and processors on the market. Agriculture with the food industry has a special economic, socio-economic and foreign trade significance. In the process of competing participants in the domestic and foreign markets, competitors strive to increase profits, market share.

Raspberry production in the analyzed period increased due to increased yields, although in most years it is maintained at a constant level. Serbia has exceptional comparative advantages in raspberry production. They are not fully valorized, but that is not the only and main problem. What is noticed is sometimes inadequate support of the state, which with its measures must accelerate and encourage producers not only to increase the yield on already planted plots, but also to expand them. That idea, as well as its realization, would be beneficial not only to the producers, but also to the entire economy. The benefits would also be reflected in the development of rural areas, because the mass production would raise the issue of infrastructure, which is currently at a very low level.

This paper analyzes the supply and demand for raspberries, ie the impact of its factors on the production process. It was found that most factors had a statistically significant impact with some that were positive and others that were negative. What can be underlined as a general conclusion is that macroeconomic indicators are very important factors in the success of production, but also the demand for raspberries. Prosperity in the economic sense, which has been noticeable in recent years, can only be a springboard that will remind economic policy makers that the comparative advantages that a country has must be used in a way that will give everyone only benefits that can be seen from different angles. The obtained research results enabled the creation of regression equations on both supply and demand sides. As these factors are of a macroeconomic nature, it is clear how important the active role of the state is as well as its promptness in adopting appropriate measures. The formulated equations on the supply and demand side can be used to predict the examined categories and to eliminate the risk of uncertainty as much as possible. In a business environment full of risk but also competition, this is a very important thing, perhaps another advantage that should be used. Considering that factors are defined on the supply and demand side, but also their importance for supply and demand, it is possible to concentrate on some of these factors and influence the consequences on supply and demand for raspberries by influencing them.

Also, it is very important to look at the competition in the global market and see the trends as well as the types of products based on raspberries. Exporting unprocessed raspberries is lucrative, but it is even more profitable to export raspberry-based products. We have to keep up with this trend, because the market is ruthless and the acquired positions are being lost very quickly. It is important to create such a relationship between buyers and sellers that will be characterized by mutual trust. Such a relationship is very difficult to lose, but difficult to achieve. Certainly, Serbia has all the necessary potentials to be a leader on the world raspberry market, regardless of the important place it occupies on a global scale. We should not forget that raspberry is the most important Serbian brand.

Conflict of interests

The authors declare no conflict of interest.

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ECONOMIC SIGNIFICANCE, NUTRITIONAL VALUE AND APPLICATION OF TRITICALE

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A R T I C L E   I N F O

A B S T R A C T

Triticale is a new type of real grain, which was created by the breeding and selection of a man. This species deserves more and more attention from both domestic producers and producers on a global scale because it encompassed all the positive properties of wheat and rye. The paper clearly presents the knowledge about the importance, nutritional value and application of triticale and the effect of its usage in a diet of monogastric animals. The variety of uses, appropriate chemical composition, acceptable and studied breeding technology, classifies triticale as an irreplaceable source of energy and protein needs of animals. Due to its multiple usages: for grain, fodder and as a raw material for biofuel, contributes to the economic sustainability of crop production. The needs of this plant at the level of agrotechnical investments are less than in other cereals, so triticale is increasingly presented in organic and sustainable agricultural production.

Introduction

Triticale as a new type of small grain was created by crossbreeding wheat and rye. The first triticale hybrids are thought to have originated in Scotland in 1875 (Stallknecht et al., 1996). The same authors point out that the first genotypes obtained by crossing wheat and rye were sterile, while the first fertile ones originated in Germany in 1888. The name triticale was first mentioned in literature in 1935 in Germany.

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Triticale presents a plant hybrid species, a new botanical genus in the family *Poaceae*, created by a man, with a tendency to combine the positive characteristics of wheat and rye. Progress in the selection and breeding of winter triticale depends on the available genetic variability, the manner of incorporation of desirable genes into superior genotypes, as well as the efficiency of selected (chosen) genotypes, lines (Ivanova and Tsenov, 2014; Milovanović et al., 2014; Đurić et al., 2015; Derejko et al., 2020).

Triticale as a new very successful type of small grain, which in the previous decades has deserved more and more attention, is becoming more and more represented and important, both among our producers and in the world. Nowadays, thanks to the intensive breeding program, especially in the Center for Small Grains in Kragujevac, there are new domestic commercial brands on the brand lists. They are characterized by a whole range of good agronomic traits, which contribute to this species becoming more attractive and occupy larger areas (Milovanović et al., 2014; Terzić et al., 2018; Đekić (Rajičić) et al., 2019; Rajičić et al., 2020b). The first domestic varieties of winter and spring triticale were created in Kragujevac (1980 and 1987), and this is the result of the fact that intergenus hybridization in the Center for Small Grains has been intensively worked on since 1960. They are characterized by a whole range of good agronomic qualities, which contribute to this species becoming more attractive and occupy larger areas. Milovanovic et al. (2007a), point out that the triticale is grown worldwide on areas over 4 million hectares. Areas under this brand are constantly increasing, so they have tripled in the past ten years. The largest areas under triticale are in Poland, Germany, Russia, the USA, China, France and Hungary. In these countries, the sown areas reached 100.000 to 700.000 ha (Benbelkacem, 2002). In Serbia, triticale is grown on 19.482 ha (mainly winter varieties) with an average yield of 4.14 t/ha, with an increasing trend of areas, so that it entered the ranks of important field plants (Rajičić et al., 2020a). Triticale is a relatively new plant species in our area, and it has only been intensively cultivated for about 20 years. In Central and Southeastern Europe, it is grown mostly in Poland (up to one million ha), and it occupies significant areas in Hungary and Ukraine. Although production has also started in Romania, which has significant areas under small grains, satisfactory results have not been achieved because winter wheat still has an advantage (Saulescu et al., 1998). Today in the world, based on data from the FAO organization in 2019, triticale is grown annually on an area of 3.808 mill. ha with an average grain yield of 3.69 t/ha. In 2019, triticale while in the Republic of Serbia it is grown on an area of 25.725 ha, with a slightly higher grain yields of 3.97 t/ha (FAO, 2021).

The significance of triticale and its prevalence

The newer brands of triticale generally reached the leading wheat sorts in terms of grain yield, while they surpassed rye, barley and oats cultivars (Milovanović et al., 2014). As a species, it showed high adaptability in our environmental and soil conditions, which caused the obtaining of stable yields. It showed high tolerance to acid soils, as well as good production results on sandy soils (Rajičić et al., 2020a). It showed a similar

advantage in terms of drought tolerance. It can be said that it inherited from his parental species a very good to excellent tolerance to the most important pathogens and pests of small grains.

Early ripening, resistance to lodging and drought, lower stems, high and stable grain yield are some of the characteristics of KG varieties of triticale transferred from wheat, as a second parent (Milovanović et al., 2006). Today, triticale is mostly used as a granular nutrient in the diet of monogastric animals, especially in the diet of pigs and poultry while in recent times it is increasingly used for silage (Djekic et al., 2011; Đekić et al., 2012a; b).

Experiments in different countries have shown that triticale grain, if not contaminated with carob or *fusarium*, has similar nutritional values to wheat, and is superior to barley (Milovanović et al., 2014). The same authors also state that the high sugar content in the green mass of triticale provides a high nutritional value of the crop, and the large production of biomass allows it to be used as a fodder plant and replace other traditional crops such as rye and oats. In the United States, autumn and spring triticale crops are used to graze livestock. Mowing winter triticale in the spring before the outbreak of the first knee enables obtaining additional fodder, and it even has a favorable effect on the crop, since it reduces the danger of lodging (Đekić et al., 2018b). High and late brands are used for green mass. The yields of the green mass reach 20 to 60 t/ha. It can be used as hay, ground hay or for preparing silage. The potential of triticale, grown under optimal conditions, in terms of yield is close to the potential of wheat and is much higher than the potential of wheat under unfavorable growing conditions (Milovanović et al., 2011).

Triticale as a new plant species is quite tolerant to later sowing dates. Increasing the sowing norm without grounds contributes to the reduction of vegetation space, greater competition between plants for food and water. As a consequence of this condition, the size of the ears decreases, the number of grains per class and the physical indicators of grain quality decrease (weight of 1000 grains and volume weight). The current assortment of triticale is resistant to low temperatures, and the causes of the deterioration of certain surfaces are often shallow sowing, lack of rolling and late sowing dates (Ivanova and Tsenov, 2014; Kendal et al., 2016; Lalevic and Biberdzic, 2016; Bielski, and Falkowski, 2017; Madić et al., 2018; Derejko et al., 2020). Only tolerant triticale genotypes with optimal plant composition and well-developed roots can withstand air and soil drought (Djekic et al., 2011; Kirchev and Georgieva, 2017; Bielski et al., 2020).

Production properties and quality of triticale

Grain yield per unit area is one of the most important factors influencing the profitability and economy of production. Grain yield, 1000 grain mass and hectolitre mass are complex quantitative properties conditioned by the action of a large number of genes under the strong influence of the external environment.

According to Milovanović et al. (2014), the mass of 1000 grains in triticale ranges from 40-65 g, while the bulk density ranges from 65 to 75 kg. Milovanović et al. (2006), examining the winter variety of triticale Favorit, in a three-year period (1998-2000), point out that the average weight of 1000 grains was 44.1 g. The same authors noticed that Favorit achieved a significantly higher average grain yield (7.21 t/ha) compared to the standard variety Kg 20 (6.45 t/ha), ie 760 kg/ha more. Such a high yield is accompanied by good technological properties of the grain, especially hectolitre mass, mass of 1000 grains, protein content and the number of falls according to Hagberg.

Perišić et al. (2008), studied the winter triticale variety *General*. Compared to the older varieties, which are widespread in production, the *General* variety is characterized by a higher and more stable grain yield. In a two-year period, the *General* variety achieved a statistical and highly important greater grain yield (6.78 t/ha) compared to the Kg 20 standard (5.77 t/ha). The protein content in the grain of the *General* variety averaged 14.6%. Milovanović et al. (2007a), state that the new variety of winter triticale *Knjaz* is lower in comparison with the standard (Kg 20) by 11 cm and that it is more resistant to lodging. In addition, the *Knjaz* variety is 3.4 days earlier than the standard. All this makes the variety *Knjaz* so far the lowest recognized, the earliest and the most resistant to lodging genotype in our country and more broadly. In addition, the *Knjaz* variety is characterized by high resistance to the causes of stem rust and powdery mildew, which is a general characteristic of triticale. It is slightly shrunken and medium-sized grain with a mass of 1000 grains of about 36 g. More than 93% of Knjaz grains belong to large fractions (above 2.5 mm). In terms of grain yield, it also surpassed the Kg 20 variety, but the differences were not statistically justified. It is a very fertile variety with wide yield adaptability. It achieved the highest yield in Zajecar (8.36 t/ha) in the experiments of the Commission, but it showed the genetic potential for grain yield in the experiments in Kragujevac and in the field, around 11 t/ha. The coefficient of variation for yield was lower in the variety *Knjaz* in relation to the standard, indicating better stability of the yield of this new variety. Based on all this, *Knjaz* variety was recognized by the Variety Commission in 1996.

Milovanović et al. (2009a), studying the winter variety of triticale *Žarko*, point out another in a series of Kragujevac varieties of winter triticale with excellent agronomic, physiological and technological characteristics. Thanks to a good genetic basis, favorable climate conditions and their interaction, the variety *Žarko* achieved a significantly higher grain yield of 8.36 t/ha, which is 783 kg/ha more than the standard variety Kg 20 (7.57 t/ha). Observing the localities and years, the variety *Žarko* achieved the highest grain yield of 9.97 t/ha in the 2004/2005 in Sremska Mitrovica. The weight of 1000 grains is about 36 g, and the bulk density is about 82 kg, which is more than the standard. The same authors point out that this variety has a high value of usage, ie it can be used for haylage and silage, or for feeding livestock in the form of concentrated nutrients. In the human diet, it can be used to produce rye-type bread.

Đekić (2010) they studied three winter hexaploid varieties of triticale of Kragujevac (Kg 20, *Favorit and Trijumf*). The best indicator of yield and grain quality in class width, number of grains per class, grain weight, grain yield per plant and grain weight

per class was achieved by the examined variety *Favorit*, and in plant height and class length by the *Triumph* variety. The standard variety (Kg 20) had the highest number of spikes in the class. The analysis of the obtained data revealed a significant dependence of the examined components of grain quality on the genotype. It was found that there were very significant differences in plant height, spike width and number of grains per spike between the tested triticale cultivars (P<0.01). The determined difference in significance between the examined triticale cultivars was important for the length of classes and grain weight per plant. No significant differences in grain weight, number of spikelets per spike and grain yield per plant were found between the examined triticale varieties.

During the two-year study, Đekić et al. (2014a), they camo to conclusion that the highest grain yield was achieved by the variety *Trijumf* (5.01 t/ha). The highest two-year mean value of 1000 grains was achieved by the *Favorit* variety (44.02 g), and the smallest by the variety Kg 20 (41.10 g). The average two-year value of hectolitre mass was the highest in the varieties *Favorit* and *Trijumf* and its walue was 65.47 kg/hl. The analysis of variance statistically determined very significant and important differences for grain yield and weight of 1000 grains between the examined years, ie environmental factors. The interaction of the examined factors (year x genotype) had a statistically very significant influence on the yield and a significant influence on the mass of 1000 grains, which indicated that the examined factors mutually had reinforced their effect.

During one decade of winter triticale breeding, two varieties (*PKB Vožd* and *PKB Kardinal*) of good agronomic and technological properties were created at the PKB Agroekonomik Institute (Đurić et al., 2011; 2015). The variety *PKB Kardinal* achieved a completely satisfactory yield of an average of 8.0 t/ha of grain in all localities and in different years from the aspect of climate, and can be recommended for the current assortment of triticale in the Republic of Serbia.

The results of three years of research on four different varieties of triticale in the Center for Small Grains in Kragujevac, Đekić et al. (2014b) indicate that all examined varieties showed a high degree of adaptability in grain yield, weight of 1000 grains and hectolitre weight, which suggested that as such they can be of great importance in large-scale production of triticale in agricultural conditions of Serbia. During the three-year trial, the highest grain yield was achieved by the *KG Tempo and Trijumf* variety (5.38 t/ha and 5.31 t/ha). The highest three-year average value of 1000 grains was achieved by the *KG Tempo* variety (45.03 g), and the smallest by the *Kg 20* variety (42.11 g). The average three-year value of hectolitre mass was the highest in the variety *KG Tempo* and its walue was 66.56 kg/hl. Analysis of variance revealed statistically very highly significant and very important differences for grain yield and weight of 1000 grains between the examined years, while the interaction of the examined factors was statistically very highly significant for yield and weight of 1000 grains, indicating that the examined factors mutually reinforced their effect.

Lalević et al. (2012), showed a significant variation in grain yield and its quality depending on the genotype, years and the dose of fertilization. In both years of testing, the winter triticale variety *Kg 20* achieved a significantly higher grain yield (5.99 t/ha) compared to the other tested variety, *Favorit* (5.16 t/ha). Differences in yield between the tested fertilization variants were statistically justified, the amount of 80 kg/ha of nitrogen, 100 kg/ha of phosphorus and 60 kg/ha of potassium, Rajičić et al. (2020a) recommend both as optimal and as the most profitable for use in large-scale production. Due to the poor filling of triticale grains, one of the disadvantages of this culture was the small hectoliter mass, which prevented the full realization of the genetic potential for the yield. On average, the hectoliter mass was significantly much higher in 2015 (83.81 kg/hl) compared to 2014 (69.03 kg/hl). Terzic et al. (2018) examined the studies with a higher nitrogen dose of 120 kg/ha on yield and yield parameters. They found that the hectoliter mass during the three-year study varied from 68.21 kg/hl in the control variant to 69.89 kg/hl in the fertilized variant with 120 kg/ha of nitrogen, 100 kg/ha of phosphorus and 60 kg/ha of potassium. Biberdzic et al. (2012), point out that the production of triticale on acid soils is most economically organized with the use of a combination of NPK, lime and organic fertilizers, as well as the use of NPK fertilizers with an increased dose of phosphorus. The most frequently applied quantities of nitrogen in Serbia ranged from 80 to 120 kg/ha depending on the agrochemical properties of the soil (Biberdzić et al., 2017; Đekić et al., 2018; Lalević et al., 2019).

According to the literature, there are significant variations in terms of chemical composition and nutritional properties of triticale, which is a consequence of the existence of a large number of genotypes with very different properties. In terms of technological quality of grain, triticale still falls behind wheat for human nutrition (lower content and poorer quality of gluten), so it is mostly used for domestic animal nutrition (Perišić et al., 2019). As triticale grain has a high protein content (2-3% more than wheat) and a very favorable amino acid composition, it is very suitable as a nutrient (Đekić, 2010). Changes in protein and grain mass in some cereals depend on the location of the grain in the class. Milovanović et al. (2007a), describing the variety of triticale *Knjaz* of Kragujevac, they have point out that its average content of crude protein in cm was 14.1%, which was 1.2% more than the standard (Kg 20). The protein content in the grain of Kragujevac varieties usually varies in the range of 14 to 17% (Milovanović et al., 2007b). The same authors have pointed out that the *Kg Rubin* variety has an average mineral content of 1.82% in the grain.

Perišić et al. (2008), compared to the older varieties of triticale, the *General* variety is characterized by a higher and more stable yield. In a two-year period, the *General* variety achieved a statistically highly significant and higher grain yield (6.78 t/ha) compared to the standard of *Kg 20* (5.77 t/ha). The authors concluded that the General variety has been an excellent component of feed mixtures and can partially or completely replace other nutrients (corn, barley, oats). According to the data collected during the test, the protein content of the tested varieties of triticale *Kg 20* and *Triumph* varied in the range from 11.36 to 14.12% cm. The Triticale *Triumph* variety had a higher average

protein content than the *Kg 20* variety (12.90 and 12.24% cm in the same order). Based on that fact, the grain of the *Triumph* variety can be said to have a relatively high protein content (12.90% cm) of high nutritional value and can be characterized by good physical and chemical properties (Đekić, 2010). Triticale has a relatively high content of proteins, which are important for the biological value and technological quality of products intended for both human and domestic animal nutrition (Đekić et al., 2014a). There are significant variations in terms of chemical composition and nutritional properties of triticale, which is a consequence of the existence of a large number of hybrids with very different properties (Đekić, 2010).

The obtained results from the research of Djekic et al. (2011) confirm that newer varieties and lines of winter triticale have lower protein content in the grain compared to the standard (KG 20), except for *Favorit, Vojvoda*, Tr 102/6, Tr 71/5-2 and Tr 110/3-2. Compared to wheat (*Pobeda*), they have lower protein content in the grain, except for the *Favorit* variety (13.87% sm). The difference between the significance of the average values of grain protein content of the examined cultivars and triticale lines with the standard cultivar KG 20 was not significant (P>0.05). The values of protein content in this research period are significantly lower than the values from previous studies (Milovanovic et al., 2009b, 2011), which is a result of year conditions and tendencies to decrease protein content in triticale due to continuous selection pressure to increase yields and grain bulk improvements. Djekic et al. (2011) found that the protein content ranged from 13,074 to 14,694% DM. They found that there were no statistically significant differences in the average values of protein content between the examined varieties of spring triticale and promising genotypes in relation to the standard variety *Vojvoda*. The average protein content of the cultivar *Knjaz* (14.694%) shows a statistically significant difference in relation to the cultivar *Vojvoda*. All this indicates that the genotypes of spring triticale have a higher protein content compared to winter.

Examining the chemical properties of grains of two Canadian winter varieties of triticale *Pika* and *Bobcat*, Salmon et al. (2002), observed that the *Pika* variety had a higher protein content of 13.1% than the *Bobcat* variety (12.9% sm), while the higher fat content (1.78% sm) and starch content (55.36% sm) had the Bobcat variety.

The content of protein and mineral substances are correlated, which means that an increase in the content of protein in the grain probably increases the content of minerals in it (Djekic et al., 2011). The nutritional value of protein depends on the content of essential amino acids (Perišić et al., 2019).

Application of triticale in poultry nutrition

Triticale is mostly used as animal feed. Numerous studies indicate that triticale successfully replaces a part of corn, wheat or barley in animal feed without negative consequences on the effect of domestic animals (Đekić, 2010). Triticale is a suitable nutrient for all types of animals because it is a high source of energy. Triticale is already widely used to feed poultry (broilers) worldwide (Johnson and Eason, 2006; De Brum et al., 2000). The nutritional

value of triticale on the production traits of heavy line hybrids (food consumption, body weight at the beginning and end of the trial period, mortality and food conversion) has been studied by a large number of researchers (Hermes and Johanson, 2004), while there were no similar researches in our country.

Camiruaga et al. (2001) examined the production characteristics of broiler chickens that were fed with a mixture based on corn or triticale. The experiment was conducted on broilers of the heavy line hybrid Hubbard. The diet was based on corn or triticale (D1 and D2) which were used in different concentrations. Two hundred and forty-day-old broiler chickens up to 28 days of age were fed with 8 different treatments (T1-T8). Treatments with odd numbers are composed on the basis of corn and treatments with even numbers on the basis of triticale. T1 and T2 had no added enzymes, T3 and T4 were with the addition of cellulose, protease and phytase; T5 and T6 with B-glucanase and phytase, and T7 and T8 received phytase only. At the end of the experiment, two chickens from each group were slaughtered to determine slaughter values. T6 group chickens had the highest body weight. The chickens of the T7 group had significantly positive differences in relation to T1, which indicates the influence of phytase in the corn grain. They found that slaughter yields ready for roasting ranged from 75 to 77%, with the T6 group chickens having the highest yield. Korver et al. (2004) show that triticale has great potential as a feed material for chickens, as it could replace wheat in broiler fattening mixtures, which would further reduce the cost of food production by about 5%. The authors concluded that by replacing wheat with triticale in the broiler fattening mixture, there are no significant changes in the production and slaughter characteristics of chickens, that the body weight of chickens fed with triticale, as well as mortality and food consumption do not differ significantly from the same characteristics in chickens which are fed with wheat.

The research was conducted to determine the best level of replacement of corn with triticale in broiler fattening mixtures. De Brum et al. (2000) examined 1,560 one-day-old chicks, male and female, which were used in the study from 1 to 42 days of age. The experiment was performed according to a randomized block system with five treatments: 0, 25, 50, 75% replacement of corn with triticale, and the fifth treatment contains mainly triticale and soy flour. At the end of the experiment, 12 chickens, six male and six female chickens were slaughtered. In the first phase of the experiment, there were significant differences between the sexes for all examined treatments in food consumption and conversion. Male chickens performed better than females.

Barneveld and Cooper (2002) examined six varieties of triticale in broiler feed mixtures. The total food consumption for one kilogram of chicken body weight varied from 1.75 to 2.24 kg. They point out that the grain of triticale had a higher content of protein, lysine and methionine, while the digestibility was the same as that of grain of wheat and corn. Shakouri and Kermanshahi (2003) examined seven varieties of wheat and a variety of triticale in the preparation of mixtures for broiler fattening. 3 groups of chickens were examined, the first, which was fed with 60% corn in the mixture, the second with 60% wheat and the third with 60% triticale in the mixture for broiler fattening. The content of total proteins in wheat grain ranged from 9.19 to 13.68%, and in triticale 13.15%.

Consumption of food in the first group of chickens in the period from 1-14 days ranged from 416-438 g, in the second group 406-427 g and in the third 427-430 g. Feed conversion in the examined chickens in the same period of age was 1.65-1.69 g/g (I), 1.62-1.80 g/g (II) and 1.73-1.89 g/g in the third groups. In order to investigate the effects of corn, wheat and triticale on the performance and digestive characteristics of broiler chickens Shakouri and Kermanshahi (2007), conducted an experiment on 288 roosters up to 57 days of age. Chickens fed with wheat and triticale had a significantly lower feed conversion. The body weight of chickens fed with wheat with the addition of enzymes did not differ from the weight of chickens fed only with corn and triticale. The stomachs of chickens fed with wheat and triticale were heavier than those of chickens from other treatments.

Comparing triticale and wheat in the diet of broilers Korver et al. (2004), prefer triticale due to higher average weekly growth of chickens, with the same amount of food intake. The same authors, examining two groups of chickens: the first group-wheat and the second group-triticale came to the conclusion that the body weight of chickens fed with triticale at the end of the experimental period was 2.11 kg, while the first group had a body weight of 2.10 kg. Higher mortality was noticed in the first group of chickens 5.5%. Hermes and Johanson (2004) claim that triticale in the diet of heavy line hybrids, which participated in different amounts in the broiler fattening mixture, did not show negative effects on the production characteristics of chickens. The highest body weight of the tested chickens was achieved with a 10% share of triticale in broiler fattening mixtures, while a higher feed conversion was achieved with the formulation with a 15% share of triticale. Sarker et al. (2006), concluded that the highest body weight at the end of the experimental period was achieved by chickens fed with the following formulations: $W_{40}T_{60}$ and $W_{60}T_{40}$. The lowest mortality was determined in the formulation $W_{100}T_0$, in a mixture without triticale. A study of 576 male broiler chickens (Cobb 500) with an initial body weight of 41.5 g that were included in the feeding experiment was performed by Jozefiak et al. (2007). The study consisted of six treatments in 12 wire floor cages (72 cages) with 8 chickens in each cage. Throughout the experimental period (1-35 days), chickens were given a mixture based on triticale-variety Presto, rye-variety *Dankowskie Zlote* or wheat-variety *Cobra*, which were fed with adlibitum starter mixture (1-14 days) and grower mixture (15-35 days). The best results were achieved by chickens fed with triticale. The body weight of broilers at 35 days of age that were fed with triticale varied from 1.54-1.61 kg, in the group fed with rye from 0.81-1.14 kg, while the group of chickens fed with wheat had a weight in the range of 1.49-1.50 kg.

The share of triticale with 65% in the broiler fattening mixture up to 21 days of age was investigated by Pourreza et al. (2007). The tests were performed on Ross hybrid chickens. Based on the obtained data, the authors concluded that the body weight of chickens at 21 days of age that were fed with triticale was 477.4 g; food conversion 1.60 kg/kg; daily food consumption per chicken 34.0 g/hour/day. Three different treatments of broiler diet (T1-control, T2-triticale and T3-whole grain triticale) in broiler diet were examined by Santos et al. (2007). At the end of the experimental period, the chickens of the T2 experimental group fed with ground triticale (2.83 kg) had the highest body weight, and the smallest

chickens were fed with whole grain of triticale (2.68 kg). Chickens of the third group (1.85 kg/kg) had the highest feed conversion during the experiment, and chickens of the second group 1.77 kg/kg had the lowest. Santos et al. (2008), tested 2.561 one-day-old Ross 508 hybrid chickens. The experiment consisted of 4 dietary meals with 40 broiler chickens per group. Dietary treatments were throughout the experimental period (from the 1 to 42 day). From the 1 to the 14 day, the chickens of the experimental group were fed with a starter mixture with 58.04% triticale (22% protein), from 15 to 28 day grower mixture with 64.71% triticale (20% protein) and from 29 to 42 they were given a finisher mixture with 70.97% triticale (18% protein). The first group of chickens was fed with a mixture with corn, the second with a mixture with whole grain corn, the third with triticale and the fourth with whole grain triticale in the mixture. The chickens of the first group had the highest body weight on the 14 and 28 day of age (405.2 g and 1.46 kg), while on the 42nd day of age the chickens of the third experimental group fed with ground triticale had the highest body weight (2.87 kg). Chickens of the third group (1.74 kg/kg) had the highest feed conversion during the experiment.

Triticale is an excellent component for preparing feed mixtures, due to its high content of amino acids and proteins, and it can partially or completely replace other or more expensive nutrients. Đekić et al. (2012a) made a comparison between chickens fed with mixtures containing and chickens fed with mixtures that contained triticale. Based on the obtained data, the authors concluded that there were statistically significant differences only in feed conversion in the examined chickens, while there were no significant differences in body weight, although chickens fed with a mixture of triticale had a slightly higher body weight at the end of fattening. Examining triticale as a nutrient in the diet of broiler chickens, Đekić et al. (2012b) found that there are very significant differences between the average body weight of chickens between K-group chickens that were fed with standard mixture and O-II group fed with triticale variety Favorit and O-I chickens fed with triticale variety Kg 20 and O-I groups. This points to the conclusion that the average body weight of O-II group of chickens before slaughter on the 42nd day of fattening will be in 99% of cases 0.099 kg higher than the K-group and 0.116 kg higher than the O-I group of chickens.

An important research was conducted by Đekić et al. (2014b), who examined the influence of triticale as a feed on the production and slaughter characteristics of broiler chickens. The research was conducted on 200 chickens for fattening, two groups, the first was control group (classic mixture) and the second experimental group (mixture with triticale Kg 20). In male chickens from the control group, the weight of thigh (259.717 g) was slightly higher than the weight of thighs of chickens of the same sex from the experimental group (243.250 g), while female chickens from the experimental group (237.100 g) had a significantly higher weight of thigh to chickens of the same sex from the control group (198.273 g), (P<0.01). In addition to weight, it is significant that the proportion of abdominal fat was lower in the examined groups of chickens of both sexes that were fed with triticale. The weight of meat of chicken drumsticks of male, female and both sexes from the experimental group (173.933; 165.917 and

169.925 g) was higher than the weight of chicken drumstick meat from the control group (172.400; 159.617 and 166.008 g), but in the samples of meat of the drumsticks of female chickens, the difference was significant.

Đekić et al. (2015) examined how triticale in feed mixtures for broiler fattening affects the growth, production and slaughter characteristics of broiler chickens. The research was performed on 400 chickens for fattening, provenance Ross 308. On that occasion, four groups or treatments were formed, with 100 chickens in each group. The first group was fed with the classic broiler fattening mixture (starter, grower I, grower II and finisher) and served as a control group. Other groups of chickens were fed with mixtures containing 7.5%, 12%, 15% and 18% triticale. So, four groups of broiler chickens were formed, with 100 broiler chickens in each group, control group fed with a classic mixture for broiler fattening, B-group (fed with a mixture containing triticale of genotype Kg 20), C-group (fed with the triticale Favorit) and D-group (fed with the triticale Triumph). The experiment of feeding the chickens lasted 49 days. During the 49th day, the body weight of chickens from the experimental C-group fed with the variety of Favorit was higher by 6.59%, compared to the control group, while the body weight of chickens from the D-group fed with variety of triticale Triumph, had a higher body weight by 2.02%, than chickens fed with a mixture without triticale. The best results in the body weight of chickens before slaughter, weight of chickens ready for roasting and ready for grilling were achieved by broiler chickens in C-group after 49 days of age.

Given the above results (Djekic et al., 2011; Đekić, 2010; Đekić et al., 2012b; 2014b), it can be said that the obtained values related to body weight and weight gain, fit into the general conclusion, that tririkale added to chicken feed, does not negatively affect the absorption of nutrients from the experimental mixture. The authors concluded that triticale can very successfully replace wheat and in broiler feed rations, because the food needs in the world are increasing, and the areas under wheat are decreasing.

Application of triticale in pig nutrition

Triticale is mostly used as animal feed. Numerous studies indicate that triticale successfully replaces a portion of corn, wheat, or barley in pig feed mixtures without negative effects on their performance (Coffey and Gerrits, 2009). The possibility of using triticale in the diet of pigs was studied by Kovcin and Stanacev (2004). Based on a review of literature data, they point out that triticale can be included in pig feed mixtures up to 60% of the total amount of cereals. Further increase of triticale in piglet mixtures leads to a decrease in growth. Also, the amount of trypsin and chymotrypsin inhibitors in older varieties of triticale is quite high, which negatively affects the use of this nutrient in the diet of pigs.

The influence of triticale levels in the diet of chosen piglets was investigated by Erickson et al. (1979). The authors examined the different participation of triticale in the diet of chosen piglets in the following quantities: 0, 20, 40, 60, 80 and 100% of total cereals. Based on the obtained data, they concluded that the increase of triticale in the diet of

chosen piglets above 60%, leads to a decrease in growth, while food consumption is higher. However, if synthetic lysine is included in the mix, a further increase in triticale of up to 100% is possible, stopping the decline in piglet growth, but increasing food consumption, which is justified by the high proportion of cellulose. Triticale in the initial stages of fattening pigs has similar nutritional properties as, but in the final stage of fattening Mayer and Barnett (2008) give preference to. In addition to, triticale is very successfully replaced by soy flour in pig feed mixtures.

Mayer and Barnett (2008) point out that the content of the amino acid lysine in pig fattening mixtures is more important than the content of crude protein, because examining mixtures with and without triticale with the same crude protein content, found that pigs fed with the mixture which contains triticale have higher growth and meat yield. Sullivan et al. (2007) examined three groups of piglets that were fed in the summer and winter months. The first group of pigs was fed with a standard mixture without the participation of triticale, the second contained 40% triticale and the third contained 80% triticale. The authors concluded that food consumption in the summer months was higher compared to the winter months and that the lowest food consumption per unit of growth was in the group fed with 40% triticale. Studies that were conducted in Canada using triticale in pig nutrition (Robertson et al., 1999) indicate that and barley grain can be successfully replaced with triticale grain in pig breeding mixtures of 25-110 kg.

Economic significance of triticale

The concept of sustainable development of agriculture implies an integrated system of agriculture, whose basic task is to achieve economic, environmental and social goals, which are often opposite and contradictory. Agriculture is an activity in which natural resources and the natural environment are used to implement the principles of sustainable development, which farmers themselves shape through their activities (Marks-Bielska, 2019). Profitability of modern agricultural systems is not possible without reducing agricultural inputs. By comparative analysis of input and output, we can assess the efficiency of technology and the effectiveness of farm management. (Pozubenkova and Galiullin, 2019). Haliniarz et al. (2018) point out that the analysis of economic effects in the technology of spring wheat production indicates a clear advantage of lower intensity technology in relation to more intensive technologies. This is primarily due to high costsof mineral fertilizer that could not be compensated by the obtained yields. Bielski and Falkovski (2017) stated that in the production of winter triticale, mineral fertilization has the largest share and ranges from 30.3 to 61.5% of direct costs. Kadakoglu et al. (2021), also conclude that mineral fertilization accounts for the largest share of direct costs. Other authors point out that high production efficiency can be achieved by using environmentally friendly agricultural methods and processing methods, which are less harmful to the environment (Bielski, 2014; Marks-Bielska, 2019; Pozubenkova and Galiullin, 2019). An analysis of two neighboring farms, Kołosovski and Dobek (2016), found that the application of manure increases the cost of winter triticale production.

The farm in which slurry was used, achieved a higher yield of winter triticale, which influenced the realization of a better financial result of the farm. As product quality is a very important factor, the decision on the choice of production technology must be based on the characteristics of the quality of manufactured products (Đekić et al., 2014a; Terzić et al., 2018; Rajičić et al., 2020a).

In order to demonstrate the competitive advantage of agricultural holdings, products or technologies, production costs and gross margin are used for comparison (Bielski, 2014). Pozubenkova and Galiullin (2019), point out that it is the production cost of winter triticale per unit in the 2015 year is 360.8 rubles, in the 2016 year 338.08 rubles and in the 2017 year 337.33 rubles and tends to decline. The same authors point out that when marketing costs are taken into account, the costs for 100 kg of winter triticale reach almost 362 rubles. By increasing costs and sales to a level higher than 30 and 43%, the company would make a profit of more than 2 million rubles by the third year by producing and selling winter triticale grains. Kadakoglu et al. (2021), find that the farms earned of the total triticale gross production value 8.58% from by-product income and 7.34% from agricultural support income. Bielski and Falkovski (2017) point out that the best economic indicators are achieved by applying the highest yield technologies. Profitability of production depends on the price of grain and the ratio of price and cost of production. Kołosovski and Dobek (2016) stated that a farm that used manure made higher profits, which led to an increase in economic efficiency by an average of 0.1. Kadakoglu et al. (2021), find that the relative profit value refers to the production value of 1.22 units in return for 1.00 unit expenditure for triticale production. The same authors point out it was determined that as the triticale production areas increase, the relative profit value also increases.

Conclusion

Triticale is a type of cereal created by crossing wheat and rye. Thanks to the nutritional values higher than, breeders and livestock nutrition experts have so far recommended it in the diet of all types of domestic animals. Also, it can very successfully replace wheat in meals for animal nutrition, because the needs for food in the world are increasing, and the yields and areas under wheat are decreasing. It is especially distinguished by the high protein content in the grain and the more favorable content of essential amino acids compared to other cereals. Based on all the above, it can be concluded that triticale, as the youngest type of small grain, has found its place in farming, and its quality has also improved in livestock production. It is increasingly present in the human diet. All of the above gives it the right position as one of the promising plants of the future.

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Conflict of interests

The authors declare no conflict of interest.

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AGRICULTURAL SUSTAINABILITY AND SOCIAL RESPONSIBILITY

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A B S T R A C T

Exchange of the drought and precipitations due to climate changes is preventing higher agrarian output. Although modern technology and methods of farm production may be the answer to this question, these raise public concerns about employment and environment quality. Because of demographic and technological lagging, some countries face other problems of achieving agronomic sustainability. In this paper, the importance of sustainable agriculture development, legal bases and some aspects of agricultural social responsibility are explored. Comparative and logical deduction methods of reviewing the selected international and national documents and literature were employed. Authors conclude there are adequate legal frameworks for agricultural social responsibility and the discussion if agriculture's moral priorities affect its economic performance will never end.

Introduction

Traditional methods of achieving a higher agricultural yield are being replaced by introducing innovations like "precision farming", automation and digitization. As the application of more efficient pesticides, specific methods of farming and other advanced measures spread so is the importance of public concerns about the impact of agricultural modernization on social and environmental issues.

However, the use of new technologies may mitigate environmental risks and concerns, but not social issues as we will see in this paper. For example, the farm machinery can

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be given targeted pesticide application and irrigation orders, while providers of data analytics can collect environmental data and comprehensive plant pathogen information that can be called up at any time to improve the crop management (Bayer, 2016, 77). On the other hand, social issues may not be as quantifiable as environmental impact.

With stable World population growth, there has been a need to accelerate nourishment production to ensure sustainable development. United Nations (UN) estimate that the current world community is expected to reach 9.7 billion in 2050 (United Nations, 2015a), whereas the UN's Food and Agriculture Organization (FAO) suggested that the food production would have to double by 2050 to meet projected demand (Food and Agriculture Organization of the United Nations, 2009, 13). However, the capacity of present resources and technologies that should meet the demands of a growing population for food and other agricultural products remains uncertain (Popović, Kovljenić, 2017, 1500; Stevanović, Đurđević, 2018, 82). Exchange of the drought and precipitations due to climate changes is preventing higher agricultural output. However, together with the population rising and greater consumption, the world may need even more ideas and innovative methods that will create major farming revolution. The common answer lies in sustainable development partly by the agricultural social responsibility (Hereinafter: ASR).

In this paper, the authors explore importance of sustainable agriculture development, legal bases and some aspects of agricultural social responsibility.

Sustainable agricultural development

Norwegian Prime Minister Mrs Gro Harlem Brundtland developed at the end of the 80s generally accepted definition of the sustainable development. It takes into account progress that satisfies current needs and ensures the future generations capability to meet their essentials (Brundtland, 1987, 27). One of the proclaimed goals in the UN Resolution 70/1. Transforming our world: the 2030 Agenda for Sustainable Development was to eradicate famine, create a food security system that would enhance the diet and promote viable agriculture (United Nations, 2015b, Goal 2). The priorities in the said UN Resolution on sustainable agriculture show its multifunctional dimension as one of the important tools in sustainable development management. It is reflected in social, economic and environmental roles. As claimed by Bitsch, most authors use various approaches to the models' concepts of sustainability and social responsibility on equal footing (Bitsch, 2011, 1). Also, some authors claim that sustainability serves as a prospective explanation of the need for CSR (Porter, Kramer, 2006). The moral acceptability of conduct or a decision depends on the way of observing the outcome. Put differently, is Monsanto (agricultural company faced with controversy in the USA over genetically modified wheat and herbicide products – added by the authors) behaving ethically or practicing "sustainable agriculture" by producing genetically modified seeds or is eradicating poverty in developing nations their corporate social responsibility (Hereinafter: CSR) strategy? (Smith, 2011, 71).

It is customary to claim that social sustainability impacts society through societal, social, labor and general human rights (Bitsch, 2011). Hohnen and Hediger point out that building social capital is as important as economic and natural resources (or raw materials) for CSR. They claim where social capital refers to the firm's relationship with society, how it is perceived and regarded (Hohnen, 2007, 77; Hediger, 2008, 10).

In line with the Brundtland definition, transposition of the principle of sustainability into a legislative form is part of the countries' constitutions. Those constitutions are phrased differently but reflect the essential meaning of sustainability. For example, the Constitution of the Federal Republic of Germany provides the state protects the basics of life and the animals as the responsibility for the generations to come (Basic Law for the Federal Republic of Germany). Serbian Constitution stipulates the Republic of Serbia shall ensure a uniform and sustainable regional development in accordance with the law. It shall regulate and provide systems for the protection and enhancement of the environment, flora and fauna, whereas municipalities are competent for the improvement and use of agricultural land (Constitution of the Republic of Serbia). Rules of a sustainable conduct from the Constitution are transposed in detail by law. For example, there are general and particular principles of fiscal policy in the Serbian Budget System Act, whereas only a few of them are dedicated to sustainability. The standard of fairness requires the fiscal policy management must take into account its impact on the welfare of all generations. However, the management of the national assets and liabilities and resources must not burden upcoming generations (Budget System Act).

On the European Union level, the European Commission has also stressed the importance of corporate social responsibility for sustainable development in A Renewed EU Strategy 2011-14 for CSR (European Commission, 2011). European Commission claimed that "Through CSR, enterprises can significantly contribute to the European Union's treaty objectives of sustainable development and a highly competitive social market economy (European Commission, 2011, 3)."

The European Commission survey from December 2017, showed 55% of the respondents were most likely to say one of the primary farmers' responsibilities in society was providing healthy food of high quality. Additional 25% say it is about protecting the environment and tackling climate change (European Commission, 2018, 6). How important is to promote adequate policies and work on enforcement of their goals confirms half of all respondents in 24 EU member countries. They agree the Common Agricultural Policy is fulfilling its role in preserving the environment and tackling climate change (European Commission, 2018, 12).

The same challenges bother Serbian agricultural production as well, where the modernization of the agricultural machinery remains a particular issue that need to be addressed. The average area of the agricultural land cultivated by a two-axle tractor was 8.5 hectares according to the Strategy of Agriculture and Rural Development of the Republic of Serbia for the period 2014-2024 (Hereinafter: The Strategy) (Strategy of Agriculture and Rural Development of the Republic of Serbia for the period 2014-

2024, 2.2.4). Authors of this document claim that the Serbian farmers use agricultural machines with narrower operating span, incurring higher fuel consumption and harvest losses, which additionally increase production costs (Strategy of Agriculture and Rural Development of the Republic of Serbia for the period 2014-2024, 2.2.4). Likewise, aged machinery and scarce investment hinder the increase of the productivity and profitability of the Serbian agricultural sector. Also, intensive manufacturing and longer food supply chains may be associated with higher greenhouse gas emissions from production machinery. This explains why Serbian agriculture urgently needs modernization of the machines and equipment. Size of agricultural holdings augmentation, health security standards, and animal welfare and climate changes are some of the reasons.

As seen from the above, achievement of the sustainable development remains a complex issue for many reasons. Despite EU agriculture having made real progress on the climate and nature front since 1990, food production continues to put a strain on our environment (European Commission, 2019, 19). Still, a way to improve the environmental sustainability of the global food system as claimed by the UN Food and Agriculture Organization is the loss and waste reduction (FAO, 2019). However, based on a few studies, this organization has concluded that efforts based on business considerations alone are unlikely to resolve said production issues (FAO, 2019). That necessitates a change of the economic and legal landscape under which decisions about food loss and waste are made. To this end, the European Commission adopted a Delegated Act on 3 May 2019, laying down a common food waste measurement methodology. Such methodology serves for quantifying those indicators at each stage of the supply chain (Commission Delegated Decision (EU) 2019).

Regarding what principles sustainable agriculture should follow, Ganzi has claimed it must produce high yield and nutrition quality crops keeping resources use at the lowest level; minimize any adverse effects on the environment and make every effort towards positive sustainability contributions; utilize the renewable assets more often than non-renewable resources; and should give the local communities ability to keep and progress in their well-being (Ganzi, 2006, 4). Notwithstanding Ganzi's alimentary, environmental and social principles, Tarnapol Whitacre highlights an economic aspect of agricultural sustainability reflected in the profitability and viability of the farming business. As they claim, once achieved, it represents a process that changes farming systems permanently in accordance with the socially determined consistency goals. More concisely than the above Ganzi's principles, they define agricultural sustainability by four generally agreed upon goals: satisfy various needs, improve ecological aspects, achieve economic stability of agriculture and take forward the farm and society life quality (Tarnapol Whitacare, 2010, 1).

Agricultural social responsibility

Corporate social responsibility is understood to be the way companies combine social, environmental and economic concerns into their values, culture, decision making, strategy and operations. By applying such values and practices they contribute to the well-being of an individual and society (Hohnen, 2007, 5; International Organization

for Standardization, 2010). Hohnen advocates for a pragmatic "license-to-operate" approach. This approach offers a concrete way to identify social issues vital to the company's stakeholders and fosters dialogue with local government, community and non-governmental organizations. In the view of Caroll, CSR involves the conduct of a business so that it is economically profitable, law-abiding, ethical and socially supportive (Caroll, 1999, 286). Caroll explains the expression „socially supportive" as a voluntary or philanthropic part of the social responsibility. However, we believe such concepts are hardly acceptable in the context of agricultural production.

As something sensitive to regulate by imperative legislation, guidelines of the various international organizations are vital for adopting good governance and production practice in agriculture. Some of these, recommended by the BNP Paribas, are FAO Voluntary Guidelines on the responsible governance of tenure of land, fisheries and forests in the context of national food security 2012; OECD FAO Guidance for Responsible Agricultural Supply Chains 2016 (to help enterprises observe existing standards for responsible business conduct along agricultural supply chains); World Bank Environmental, Health, and Safety General Guidelines 2007 (for Agribusiness and Food production sectors); The CEO Water Mandate's Corporate Water Disclosure Guidelines Toward a Common Approach to Reporting Water Issues, September 2014 and other guidelines and certifications (BNP Paribas).

In the absence of imperative statutory provisions that would direct sustainability initiatives in a desirable course, morality and conscientiousness in agricultural production are of utmost importance. And corporate social responsibility represents only one component of sustainable development. A typical example is producers and retailers who increasingly engage in CSR initiatives to show their commitment to sustainability issues like animal welfare and environment (De Olde, Valentinov, 2019, 415). However, large and small individual farms can contribute both positively and negatively to sustainability in various degrees. Tempting question if it is worth pursuing sustainability objectives or maintaining the imperative balance between various aspects of sustainability (e.g. economic viability, ecosystem functioning, social responsibility, and food characteristics) is basically a social choice (Tarnapol Whitacre, 2010, 271). Continuity of work processes in farming together with the everyday family life, made Bitsch express concern on the social aspects of farmers' production and responsibility (Bitsch, 2011, 2). Whatever the approach to steering the ASR, Tarnapol Whitacre claims maintaining farm profitability is a critical link to ensuring farm dollars circulate in the local economy (Tarnapol Whitacre, 2010, 73).

Higher food production at low prices for consumers with a fair income for farmers was an ethical conception of justice and fairness for many decades (De Olde, Valentinov, 2019, 422–423). Today, agricultural social responsibility dictates an essentially different approach from this principle. However, mechanization, use of milking machines, digital farming, etc. reduce the necessity of using too much manual work. For example, in the area of animal production, in longer period, numbers of animals remained rather constant or increased, while the number of full-time farm workers hardly increased resulting in more animals per labor unit (De Olde, Valentinov, 2019, 422–423).

With farming systems' industrialization there have been growing concerns over negative socio-economic impacts on the local communities. As found in the literature, the majority of empirical studies (57%) confirmed the negative effects of industrialized agriculture on the community well-being when it comes to quantity and quality of the farm jobs, the extent to which farms purchase inputs and sell outputs locally, the local poverty rate and the level of income inequality (Tarnapol Whitacre, 2010, 73).

What can be claimed for some agricultural regions as regards to jobs density, does not apply for the agriculture in general. Agriculture still provides the highest proportion of jobs. It plays an important role in less developed countries, where farming jobs make a considerable share of the total workforce compared to less than 5% in France, Italy and Spain (Rivoal, 2012, 198).

In the area of metrics, labor issues are more difficult to measure than environmental impacts. Labor concerns include wages and benefits, health and safety, stable employment, compliance with laws and international conventions and employee participation in improving workplace conditions (Bitsch, 2011, 3; Hohnen, 2007, 24). Contrary to these views, a survey conducted in Ukraine in spring 2016 has shown the most of the agricultural managers does not consider staff development and improving working conditions as an important part of CSR (Levkivska, Levkovych, 2017, 106).

Production of more and more food is as important as achieving and maintaining its sufficiency and safety. Therefore, there is a general agreement that to pursue agricultural sustainability and responsibility in farming systems, farmers need to apply complex cropping rotations, integrated crop and livestock production and use environmentally friendly means to control vermin and crop disease-prone nature (monitoring their recognizing their interconnectedness and interactions with the environment) (Tarnapol Whitacre, 2010, 2; FAO, 2019). To this end, in Serbia farms with fragmented holdings and applied organization of production, have high production costs and inefficient use of resources (Popović, Kovljenić, 2017, 1501).

How important is the creation of jobs and economic growth in rural areas of the less developed regions shown in the EU Special Eurobarometer survey from December 2017. In 28 EU Member States, about 25% of the farmers believe the environment protection and addressing climate changes are more important than agricultural growth and creation of jobs. There are 27% in Hungary, 28% in Romania, 30% in Croatia and 34% farmers in Bulgaria of the opposite belief (European Commission, 2018). This could mean farmers in the latter countries will be less likely environmentally mindful. They will also be careless about creating conditions for stronger economic development and addressing labor concerns. For example, although large agricultural companies are major investors and employers in rural areas of Ukraine, they are sometimes blamed for exploiting resources and are careless about the environmental consequences (Levkivska, Levkovych, 2017, 98). As outlined in the Serbian theory, most advanced countries should recognize preferential treatment to undeveloped countries as a support in their efforts to access foreign markets of agricultural products (Rabrenović, Popov,

Stamenović, 2020, 75). If such a step is undertaken, preferential treatment could be one of the fundamental aspects for boosting the ASR.

One may ask himself is there really an agricultural environmental responsibility? There are at least two reasons for such a question. Firstly, sometimes reckless companies and people intend to conceal the harmful consequences of their ill-managed practice and mitigate its relevance for the specific event. Consequently, if they succeed to show the soundness of their practice in the specific event, they can exonerate themselves from civil liability for environmental damage. Secondly, carbon, land and water footprints are dependent on the food product, production method and the stage where loss or waste occurs. The land and water footprints of food are concentrated at the primary production stage. Despite significant amounts of water may be used during processing, greenhouse gases' emissions may occur and accumulate along the entire supply chain (FAO, 2019, 92). This "dilemma" shows how sustainability and responsibility of the agricultural business can be defended somewhat immorally.

Beside economic and social aspects, socially responsible agriculture is distinguished by the efficiency of the environmentally friendly production methods and minimization of their business's negative consequences. Otherwise, it risks being blamed by NGOs or mass media if they do not behave in an adequate way, which can negatively affect their reputation and financial performance (Hediger, 2008, 9; Hohnen, 2007, 2).

The moral complexity of corporate social responsibility in agriculture is the same as in other parts of the economy. How to converge economic, social and environmental goals and keep the image of a responsible business towards the public is a moral question. The answer can show the boundary between socially acceptable and irresponsible organization. Moral complexity means that quite many societal expectations directed toward agriculture are marked by a high degree of moral legitimacy. However, they are far from converging on any consensus (De Olde, Valentinov, 2019, 420). As CSR is strongly imbued with a moral imperative, it is the nature of moral obligations to be absolute mandates, while most corporate choices involve balancing competing values, interests, and costs (Porter, Kramer, 2006). As something beyond what is required by the law, ethical responsibility represents the behaviors and ethical norms that society expects business to follow (Caroll, 1999, 283). Moral motivation, manager's personal ethics and values (Levkivska, Levkovych, 2017, 100; De Olde, Valentinov, 2019, 425) are embraced by the concern for the welfare of all generations and belief that it is the "right thing to do" and concern for the welfare of present and future generations (Hohnen, 2007, 13). These are some of the CSR's internal drivers decisively influencing the balance between company's business goals and social and environmental conduct. One may argue CSR could be burdensome for improving business's financial performance if often or to a significant extent pays attention to social and environmental issues. However, some authors claim both models can produce the same results if managed as a system. That implies the inclusion of wealth production and distribution, ethical systems and sustainable management practices (Smith, 2011, 30; Hohnen, 2007, 11; Hediger, 2008, 4).

In economic theory, there is a general agreement about corporate social responsibility correlation with profitability, but disagreement over its effect. One group of authors concluded that corporate social performance and research & development (Hereinafter: R&D) aspects are highly correlated. Furthermore, when R&D intensity is included in the equation, corporate social performance is shown to have a neutral effect on profitability (McWilliams, Siegel, 2000). The other group found that the corporate virtue in the form of social and, to a lesser extent, environmental responsibility is rewarding in more ways than one (Orlitzky, Schmidt, Rynes, 2003, 427).

Conclusions

The generally accepted principle of sustainable development of human society has been a matter much discussed in theory and recognized by international institutions and various initiatives. They all agree a sustainable development is a starting point for a better, peaceful and justly developed world. This concerns both present and future generations.

International and national levels of legal regulation provide adequate bases for agricultural social responsibility.

However, there are many obstacles to the achievement of sustainable development. These refer to the social and environment issues affected by the economic expectations in terms of productivity and profitability of the agribusiness. Specific methods of agricultural production and food distribution are additional aspects in that field.

Morality is another dimension of the CSR relevant for differentiation of the agribusiness's acceptability by the society from irresponsible conduct forms. Although CSR may prove to be burdensome for improving business's financial performance, there is disagreement over its effect on profitability. Notwithstanding the importance of the sustainability and social responsibility of the agribusiness, discussion if the moral priorities affect agriculture's economic performance and core activity will never end.

Conflict of interests

The authors declare no conflict of interest.

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ACCOUNTING INFORMATION AS THE BASIS FOR STRATEGIC MANAGEMENT OF AGRICULTURAL ENTERPRISES

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A B S T R A C T

A key place in economic theory belongs to learning about the position of immediate creators, i.e. producers of goods in every socio-economic formation. This position and all relations in production and society depend significantly on the historical form of production of excess work and the way of appropriating excess work. Therefore, for analysis of the modern way of commodity agroproduction, it is necessary to dispose of information that is the basis for decision-making at the strategic level. This type of information is characterized by the accounting information system as one of the main sources of business information. For the subject of this work, we will take the modern way of agroproduction and creation of excess value, which in recent times, especially after the global economic crisis, is gaining increasing significance in both economic theory and economic reality.

Introduction

Today, as the world becomes an economic global village, and national economies powerless to counter the growing expansion of the world's most developed countries, the market way of creating value seeks new sources of information for the decisions of producers, including those with the slowest capital turnover - agrocontractors.

The development of small commodity production and the effect of value laws leads to a differentiation between small commodity producers. Namely, the law of values, as the most general law of any commodity production, acts by objectively

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differentiating agrocontractors to those who fare better in a competitive fight. In contrast, agrocontractors whose costs are necessarily economically declining as independent commodity producers. Thus, within the small commodity production there are substantial differences between economic power and the ability of individual commodity producers, one begins to get rich, while on the other side we have poverty (Milojevic, 2017). This process of polarization and differentiation of commodity agrocontractors is intensified by the development of production, and is particularly pronounced in transition countries.

Appropriating surplus products during the development of economic relations takes different forms, but basically this is the use of work, whether it is the excess work taken over the tower (work), in finished products (natura) or in the later stages of developing a society in money (Urlic, 2014). Hence the various names for forms of excess work alienation such as working rent, natural rent and monetary rent.

Countries in transition, as well as those underdeveloped countries, are characterized by the disintegration of large commodity agroproduction and follows the development of craftsmanship and small commodity agriculture, as well as the initial accumulation of capital, where social property is converted into private (Tomasevic et al., 2019).

The expansion of the market as a global village demands a fresh technology of agricultural production that can respond to the increasing market demand and also as a different legal and economic position to the basic mass of the working population. It demands the abolition of any worker bond for employers, which basically clashes with capitalist order (Jablan, 2019). The demands and use of the workforce and inactive population by the state and employers accelerate the struggles for their rights to work and wages and a more humane way of looking at the workforce than the general observation in the form of goods.

In these conditions, agro-production accounting information is aimed at creating additional value for shareholders and successfully achieving the goals set.

The subject of this work is the possibility of applying accounting information in the decision-making of business decisions of agribusinesses (Malinic, 2021). The aim is to use adequate quantitative accounting information properly to make optimal decisions by agribusiness management.

Production and creation of values as a prerequisite for making strategic decisions

In the process of agroproduction, in addition to the process of value creation, the process of creating excess value, i.e. the process of fertilization values. The value of each commodity determines the ratio of the market price and the cost to its production, the value of the products is the result of amount of value set in it. Certain means of operation and raw materials are required for each production, which means that the value of these production assets goes into the value of the goods produced by these

assets (Urlic, 2014). When we talk about the production of some goods, the processes of work for the production of raw materials and means of work are time-separate, so we can take these previously done and determined works as parts of the work needed to produce value.

Here, different concrete works used to produce labor or raw materials involved in the production of a new product, we reduce them to abstract work, because we consider them parts or phases of the same process — the consumption of human energy in the most general sense (Savic, 2020).

In addition to procurement of production assets, a workforce is needed to drive these means of production. The genesis of this two gives the value of the product as a result (Gulin et al., 2011). However, the value of the new product needs to be greater than value of the work that is already included in the production assets plus value which is spent on production the life supplies needed for the workforce (Mirovic, 2018).

The spending of the workforce in the manufacturing process means adding to the already devoted work in the production assets that go into the value of the new product, the amount of work that is greater than the amount of work required to produce the life supplies that go into the value of the workforce (Horngren et al., 2012).

Application of integral in the processing of accounting information

Quantitative methods occupy a high position in economic analyses (Paul, 2015). In the course of this work, we will apply integration and differentiation methods to accounting data to confirm the assumption that using accounting information can create a platform for the bottom lines of strategic decisions in agribusinesses.

When two inverse operations are performed consecutively over a size, for example, over a variable, x then their action is reversed and the size remains unchanged, that is, the size of the operations (Damnjanovic, 2018).

$$\int dx = x + C$$, C - integration constant.

The reason another arbitrary constant appears is easy to understand. x As a matter of fact, $dx = d(x+C)$ is $\int dx = \int d(x+C) = x + C$. Otherwise, this constant is vague and is also referred to as an indefinite integral.

This inverse differentiation operation can also be understood as follows. Under sign

$\int$ is a differential, that is, a differential. product of the function statement and third variable differential.

Modern analyses of economic problems are often used in ways of differences and differential equations (James, 2015). The first ones come in discreet and the second in continuous *dynamic* models. The model being considered up frontis

a static model of the market. Such a model does not provide opportunities to include the development of some economic situation in time.It can, however, be dynamite to include time explicitly (Stanojevic, 2016).

An example of a simple differential equation provides discounted caps. If the value of capital is at the end of the year of capitalization C_x C_0 x and the annual decursive interest, then p

$$C_{x+1} = C_x + \frac{p}{100} C_x, \text{ or}$$

$$C_{x+1} - C_x = \frac{p}{100} C_x.$$

which can be written as follows:

$$\Delta C_x = \frac{p}{100} C_x \tag{1}$$

i.e. as a simple equation, an equation of difference (Ilic, 2019). This name comes from there, which in this equation stands a function and one of its (final) differences C_x $\Delta C_x = C_{x+1} - C_x$. It'scapital, it's C_x a function of capitalization time. Unoften $C(x)$ it'swritten C_x, since the time (i.e. independent variable) in the symbolism of financial mathematics usually occupies the place of the index.

And how does it depend C_x from x? In other words, what is the shape of this function? The answer to that question is familiar and is in every textbook of financial mathematics.The function looks like this:

$$C_x = C_0 \left(1 + \frac{p}{100}\right)^x.$$

It's the solution to the upper differential equation (Benaissa, 2021). We can easily make sure that this exponential function really satisfies the equation (1).

$$\Delta C_x = C_{x+1} - C_x = C_0 \left(1 + \frac{p}{100}\right)^{x+1} - C_0 \left(1 + \frac{p}{100}\right)^x =$$

$$= C_0 \left(1 + \frac{p}{100}\right)^x \left(1 + \frac{p}{100} - 1\right) = \frac{p}{100} C_0 \left(1 + \frac{p}{100}\right)^x = \frac{p}{100} C_x.$$

If interest rates match the principal at the end of each semester, then

$$C_{x+\frac{1}{2}} = C_x + \frac{1}{2} \cdot \frac{p}{100} C_x ,$$

where it is now $x = 0, \frac{1}{2}, 1, \frac{3}{2}, \ldots$

Not at all if it's capitalization time m - part of the year, we have

$$C_{x+\frac{1}{m}} = C_x + \frac{1}{m} \cdot \frac{p}{100} C_x ,$$

where is $x = 0, \frac{1}{m}, \frac{1}{m}, \ldots$. That's where it's coming

$$C_{x+\frac{1}{m}} - C_x = \frac{1}{m} \cdot \frac{p}{100} C_x , \text{ or}$$

$$\frac{C_{x+\frac{1}{m}} - C_x}{\frac{1}{m}} = \frac{p}{100} C_x ,$$

This can be written further as follows:

$$\frac{C_{x+\Delta x} - C_x}{\Delta x} = \frac{p}{100} C_x ,$$

if $\frac{1}{m}$ replace with Δx. As m greater, i.e., the more times in one year the interest rates are matched to the principal, that is $\frac{1}{m} = \Delta x$ less, or symbolically $m \to \infty$ pulls $\Delta x \to 0$. That's when

$$\lim_{\Delta x \to 0} \frac{C_{x+\Delta x} - C_x}{\Delta x} = \lim_{\Delta x \to 0} \frac{p}{100} C_x ,$$

and that is further equal:

$$\frac{dC_x}{dx} = \frac{p}{100} C_x . \tag{2}$$

What we have received is *a differential equation* of continued capital growth, while (1) the equation is a differentiation of discreet or discounted capital growth. In this

case, capital grows continuously, continuously, while in the other case that the process takes place in jumps at the end of each subperiod Δx incisions.

Quantitative application of accounting information for strategic decision-making purposes

The application of quantitative methods on accounting data for agribusinesses will be shown on the rental mode, when the integral account is applied in the rental account, and when accounting information is available at the level of the agro-enterprise (Ilic, B., 2021). If we take that the surface of the soil R_1, R_2, R_3,..., R_n for which the rent on the end of the year (n-1) is calculated. From present value A rents are equal to

$$A = R_1 r^{-1} + R_2 r^{-2} + ... + R_n r^{-n} = \sum_{k=1}^{n} R_k r^{-k},$$

conditioned by demands that complex interest rates are the result of the decursive calculation and that the interest rate in this period is constant. If $R_k = const.$, $(k = 1, 2, ..., n)$, then

$$A = R \sum_{k=1}^{n} r^{-k} = R \frac{1}{r^n} \frac{r^n - 1}{r - 1} = R\ IV_p^n.$$

Suppose rent doesn't come in discounted, jumped at the end of each year, but flows continuously throughout the year (Rokvić-Knežić, 2020). Let it be received every year for a penny. That's when it comes in approximately R $R \dfrac{1}{365}$ dinars per day, $R \dfrac{1}{365 \cdot 24}$ dinars per hour, etc., or $R \cdot \Delta t$ dinar at a small interval of time Δt.

If rent $R \cdot \Delta t$ due afterwards t years, starting today (when the $t = 0$), i.e. at interval t, $t + \Delta t$, then its present value, with continuous interest, is approximately equal to

$$R \cdot \Delta t\, e^{-\frac{pt}{100}}.$$

What is the current value of rent at the entire interval of $t = 0$ do $t = x$ years. Apparently, it's roughly equal to the amount:

$$\sum_{\Delta t \in [0,x]} Re^{-\frac{pt}{100}} \cdot \Delta t.$$

Label $\Delta t \in [0, x]$ indicates that summaries are summoned at intervals of time Δt from $t = 0$ to $t = x$.

If $\Delta t \to 0$, sum converges integral

$$\int_0^x Re^{-\frac{pt}{100}}dt$$,

which represents *the exact* value of the considered rent at the time of $t = 0$.

In a special case, when the annual interest rate is p fixed, we have

$$\int_0^x Re^{-\frac{pt}{100}}dt = R\int_0^x e^{-\frac{pt}{100}} dt = R\left[-\frac{100}{p}e^{-\frac{pt}{100}}\right]_0^x = R\left(-\frac{100}{p}e^{-\frac{pt}{100}} + \frac{100}{p}\right).$$

Therefore, the present value of rent of dinar for the year, which flows A R continuously for years with continuous x $p = const.$, it's equal to

$$A = R \cdot \frac{100}{p}\left(1 - e^{-\frac{px}{100}}\right).$$

Obviously, A is a simple function of time x and interest rates p. It's easy to see that A depends on x. It's obvious that A is greater as the   grows, i.e., that the present value of rent increases in function of the time interval.

$$\lim_{x\to\infty} A = R\frac{100}{p}.$$

This result is interesting because it shows that *the present value of rent* in a continuous and discounted case is equal (Radovic, 2020). Therefore, the current or present value of the rent does not depend on how that rent flows or how interest is calculated (continuously or discounted).

It's easy to show that A declines when p grow (x is fixed), or symbolically:

$$\lim_{p\to\infty} A = 0$$,

since it is

$$\lim_{p\to\infty} A = \lim_{p\to\infty} R\frac{100}{p} \cdot \lim_{p\to\infty}(1 - e^{-\frac{px}{100}}) = 0(1-0) = 0.$$

Therefore, in the continuous and discounted case, the current value of rent is reduced when the interest rate rises (Ilic, 2019).

Is renting more affordable during the year continuously than at the end of the year in case of $R = 50000$ RSD for the year, $x = 28$ year and $p = 5$ annually.

That's when

$$A = 50\,000 \cdot \frac{100}{5}(1 - e^{-1,4}) = 1\,000\,000(1 - 0,246579) \approx 753\,403 \text{ Dinars,}$$

in case rent is continuously arriving on the assumption that it is done with complex continuous interest rates.

If the interest expence is discounted and decursive, and the rent is taken at the end of the year, we have

$$A = 50\,000 \cdot IV_5^{28} = 50\,000 \cdot 14,89812726 = \underline{744906} \text{ dinars,}$$

This is why the rent is better to receive during the year than at the end of the year.

Conclusion

In the modern way of agrarian production, where with the help of work means of the work, the economically viewed excess work as an economic occurrence arises after the satisfaction of the necessary work to create equivalent value.

The information revolution in the agroindustry begins with the introduction of modern information systems and technologies into the production process, which has increased labor productivity by several hundred times. The information revolution significantly changes the economic structure of individual countries, relations between individual branches of production, which affects the rapid development of the agroindustry in addition to the quarterly sector of the economy.

The impact of the information revolution is reflected primarily in the scope of the expansion of a highly educated workforce that increasingly depends on capital. By developing commodity production, excess products are sold on the market and take the form of value, namely, converted to excess value. Strategic business decision-making in these business conditions is primarily based on the application of accounting information processed by quantitative methods.

Accounting generate relevant, reliable and timely information that forms the basis for making business decisions for agribusinesses, taking into account the modern mathematical methods used to complete business decision-making grounds on a scientific basis.

We can conclude that in the global economy when the market is a product of micro markets, supply and demand globally meet at a higher level than in micro markets, thereby reducing their role in creating value drastically.

Conflict of interests

The authors declare no conflict of interest.

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PROTECTION OF SUPPLIERS OF AGRICULTURAL AND FOOD PRODUCTS FROM UNFAIR TRADING PRACTICE

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A B S T R A C T

The paper analyses unfair trading practices that arise as a result of imbalance in bargaining power between suppliers and buyers of agricultural and food products. Considering that unfair practices also exist in the relations established between consumers and traders, that special rules have been adopted in this regard, the peculiarities and differences that exist between these rules were first pointed out, i.e., in terms of the approach to regulating these practices. Furthermore, the classification of unfair trade practices as absolutely and relatively prohibited was performed, and, finally, the rules on the way in which suppliers are protected from unfair practices were set out. Basically, the method of protection (administrative protection, at the initiative of the competent authorities or at the request of relevant organizations and associations) justifies the adoption of special rules that establish an effective system of protection of suppliers from unfair trading practices.

Introduction

Farmers, processors, traders, wholesalers, retailers and consumers are all actors in the food supply chain. Smaller operators in the food supply chain are more prone to face unfair trading practices (UTPs) due to their, in general, weak bargaining power in comparison to the large operators in the chain. Unfair business conduct by operators wielding bargaining power that is not prohibited, or the existence of redress possibilities that lack effectiveness, are liable to undermine the economic viability of operators in the chain (Proposal UTPD, p. 1-2).

Imbalances in bargaining power between suppliers and buyers of agricultural and food products are a common occurrence. Those imbalances in bargaining power are likely to lead to unfair trading practices when larger and more powerful trading partners seek to impose certain practices or contractual arrangements which are to their advantage in

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relation to a sales transaction. Furthermore, certain practices might be manifestly unfair even when both parties agree to them (Preamble, No. 1 UTDP). Having on mind that agricultural production is particularly fraught with uncertainty due to its reliance on biological processes and its exposure to weather conditions and that agricultural and food products are to a greater or lesser extent perishable and seasonal, protection against unfair trading practices has become more important for operators active in the agricultural and food supply chain (Preamble, No. 6 UTDP). Such protection creates the conditions to mitigate the costs and damage suffered by producers due to unfair trade practices.[2]

Measures to combat UTPs have developed significantly in recent years. Many Member States, have recently introduced legislative and enforcement measures in order to create an effective framework to protect suppliers from unfair practices in the supply chain of agricultural and food products (out of the 20 Member States that already have legislation, 15 have introduced it in the last 5 years) (Report UTPs, p. 3). However, the state's rules on unfair trade practices are very different. It is noticeable that EU Member States have chosen different approaches to combat abuse. Some countries (for example, Germany and Austria) have regulations that require an assessment on a case-by-case basis of whether there is a significant economic imbalance between two market entities and whether a stronger entity has abused its position to impose unfair terms on the weaker party. Other Member States (i.e. Czech Republic, Slovakia, Hungary) have adopted regulations that contain a list of practices that are considered essentially unfair and therefore illegal (blacklists), i.e., fairness assessment is not made on a case-by-case basis (*Ibidem*, p. 6). The divergence of Member States' regulatory approaches to UTPs results furthermore in dissimilar conditions of competition for operators (Proposal UTPD, p. 2). This is the reason why the Proposal for a Directive on unfair trading practices in business-to-business relationships in the food supply chain pointed out the need to introduce minimum standard of protection against certain manifestly unfair trade practices in order to reduce the occurrence of such practices and to contribute to ensuring a fair standard of living for agricultural producers (Preamble, No. 7). This position was strengthened by the adoption of Directive 2019/633/EU (UTPD), which finalized the process that began a decade earlier with a focus on the functioning of the food supply chain and the emergence of unfair trade practices.[3] The adoption of the UTPD ensured significant protection to all agricultural producers and organizations from unfair trade practices, which should eventually encourage young farmers to continue farming and stay in rural areas (in surveys they cited unfair practice as the

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2   According to a 2013 survey of agricultural producers and agricultural cooperatives based on a wide definition of UTPs, the estimated damage from UTPs amounted to over EUR 10 billion per year. (Proposal UTPD, p. 10).

3   On 28 October 2009, the Commission published a Communication on the better functioning food supply chain in Europe (COM/2009/591), followed by a Communication on 15 July 2014 on tackling unfair trading practices in the business-to-business food supply chain companies (COM/2014/0472 final) and a Report on 29 January 2016 on unfair trading practices in the food supply chain (COM/2016/32 final).

main reason for leaving agriculture) (https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/ market-measures/agri-food-supply-chain/unfair-trading-practices_en).

Besides UTPD, unfair trade practices were previously regulated at the EU level by the Directive 2005/29/EC (UCPD). Both directives have been adopted for the purpose of eliminating differences between the laws of the Member States relating to unfair commercial practices in order to ensure fair competition and smooth functioning of the internal market (Preamble, No. 3 UCPD). Notwithstanding the fact that both directives are dealing with unfair trading practices, there are significant differences between them. These differences will be discussed first, followed by the rules contained in UTPD on forms of unfair practice and the enforcement authorities, which are competent to conduct proceedings and impose measures in order to prevent unfair practices.

Peculiarity and differences between directives governing unfair practices

Prior to the adoption of UTPD, there were no regulations at EU level targeting unfair trade practices among actors in the supply chain of agricultural and food products. Some countries have addressed this gap by extending the application of the rules set out in UCPD to business-to-business (B2B) transactions.[4] However, the practices referred to in UCPD are mostly different tha the ones covered by UTPD (Report UTPs, p. 3). UCPD addresses commercial practices directly related to influencing consumers' transactional decisions in relation to products (Preamble, n. 17). Unfair commercial practice impairs the consumer's ability to make an informed decision, thereby causing the consumer to take a transactional decision that he would not have taken otherwise (Art. 2, par. 1(e) UCPD).[5] In contrast, UTPD covers unfair commercial practices through which a more powerful trading partner seek to impose certain practices or contractual arrangements which are to their advantage in relation to a sales transaction of agricultural or food products (Preamble, no. 1 UTPD). Therefore, essential differences between unfair practices regulated by UCPD and UTPD can be identified, in terms of their effect, subjects of protection and objects in relation to

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4   Seven EU Member extended the application of UCPD to business-to-business transactions: Austria, Sweden, Denmark, France, Germany, Italy and Belgium. For those Member States which have extended all (Austria and Sweden) or part (Denmark, France, Italy) of the provisions contained in the UCPD to B2B transactions, the UCPD provisions as transposed into national laws will in practice replace the relevant Misleading and Comparative Advertising Directive provisions in B2B relations. It should be noted that some countries (Belgium) have also adopted specific rules for B2B. See: Mihajlović, p. 808; SWD/2016/0163 final)

5   The existence of a contractual relationship between the trader and the consumer is not a necessary condition for the application of the general prohibition of unfair business practices. However, in order to support consumer confidence the general prohibition should apply equally to unfair commercial practices which occur outside any contractual relationship between a trader and a consumer or following the conclusion of a contract and during its execution (Preamble, No. 13). See: Mihajlović, p. 805; Đurović, p. 175.

which protection is granted. In the case of UCPD, the subjects of protection are consumers in connection with the purchase and use of any product. When it comes to UTPD, the subject of legal protection are suppliers,[6] in connection with the trade of agricultural or food products, i.e., services related to the purchase of agricultural and food products.

The rules, which are contained in the directives, seek to combat unfair practices that arise as a result of inequality of actors involved in transactions. When it comes to the consumer, the relationship between the trader and the consumer, which is *a priori* unequal, justifies a special consumer protection regime (Mićović, M., Mićović, A., p. 25). Basically, consumers are protected because they do not have the necessary knowledge (expertise) and experience in relation to a sales transaction, which could lead to an unfairly unfavorable position in relation to a trader (Keirsbilck, p. 241-242). Suppliers, as subjects of protection under UTPD, are protected if they have subordinate position in economic terms in relation to the buyers of their products. The process of defining subject matter and legal scope of the rules governing unfair trading practice at the EU level, has gone through two developmental stages. The Proposal for a Directive granted protection to small and medium-sized suppliers in the food supply chain when they sell food products to a buyer that is not a small and medium-sized enterprise (Art. 1, para. 2). A targeted protection of small and medium suppliers in the food supply chain was justified because they are often the ones who cannot defend themselves against UTPs due to their lack of bargaining power (Proposal UTPD, p. 1, 9). With the adoption of UTPD, the position on when there is a relationship of inequality, and thus the right of suppliers to protection, has changed. The criteria for determining inequality is no longer mere status of suppliers (micro, small, medium enterprises), but rather differences in bargaining power between suppliers and buyers.[7] In case discrepancy in bargaining power exceeds the established limits, there will be a relationship of inequality and the right of suppliers to protection from unfair practices. Accordingly, UTPD provides applies to certain unfair trading practices which occur in relation to sales of agricultural and food products by: (a) suppliers which have an annual turnover not exceeding EUR 2 000 000 to buyers which have an annual turnover of more than EUR 2 000 000; (b) suppliers which have an annual turnover of more than EUR 2 000 000 and not exceeding EUR 10 000 000 to buyers which have an annual turnover of more than EUR 10 000 000; (c) suppliers which have an annual turnover of more than EUR 10 000 000 and not exceeding EUR 50 000 000 to buyers which have an annual turnover of more than EUR 50 000 000; (d) suppliers which have an annual turnover of more than EUR 50 000 000 and not exceeding EUR 150 000 000 to buyers which have an annual turnover of more than EUR 150 000 000; (e) sup-

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6   Supplier means any agricultural producer or any natural or legal person, irrespective of their place of establishment, who sells agricultural and food products; the term 'supplier' may include a group of such agricultural producers or a group of such natural and legal persons, such as producer organisations, organisations of suppliers and associations of such organisations (Art. 2. para. 1 (4) UTPD).

7   A dynamic approach, which is based on the relative size of the supplier and the buyer in terms of annual turnover, should provide better protection against unfair trading practices for those operators who need it most (Preamble of UTPD, No. 9)

pliers which have an annual turnover of more than EUR 150 000 000 and not exceeding EUR 350 000 000 to buyers which have an annual turnover of more than EUR 350 000 000 (Art. 1, para. 2).[8] UTPD also applies to sales of agricultural and food products by suppliers which have an annual turnover not exceeding EUR 350 000 000 to all buyers which are public authorities.[9]

Unlike UCPD, which adopted a three-step assessment approach in determining fairness of a particular trader's business practice (general clause, which sets out the general conditions that must be met in order for a trader's business to be considered unfair;[10] rules on misleading and aggressive commercial practices on the basis of which the unfairness of the practice is determined; a "blacklist" of commercial practices considered unfair regardless of the circumstances of the particular case) (Jovičić, p. 597; Mihajlović, p. 540; Radončić, p. 381), a simpler, two-step approach was adopted in UTPD: fairness assesment of trading practices is determined on the basis of the general clause and the enumeration of practices which are classified as absolutely and relatively unfair.

Although both directives envisage general clause, as a general rule for determining unfair practices, directives differently regulate composing elements of general clause which need to be cumulatively fulfilled. The existence of unfair commercial practices pursuant to UCPD requires two elements to be cumulatively fulfilled: first, the trader's conduct must be contrary to the requirements of professional diligence,[11] and second, such conduct must distort or is likely to materially distort the economic behaviour

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8   Concretization of this criteria enables "objectively subordinate supplier" to initiate proceedings against an "objectively stronger customer".

9   Public authority means national, regional or local authorities, bodies governed by public law or associations formed by one or more such authorities or one or more such bodies governed by public law (Art. 2, para. 1(3) UTPD).

10   The abstractness of the general clause ensures the sanctioning of every form of unfair practice, which enables adequate monitoring of market development and traders' business conduct (Đurović, p. 181).

11   According to the Art. 2, para. 1, point h) of the UCPD, professional diligence means the standard of special skill and care which a trader may reasonably be expected to exercise towards consumers, commensurate with honest market practice and/or the general principle of good faith in the trader's field of activity. This provision is more clearly defined in Serbian Law on Consumer Protection (Off. Gazette of the RS, No. 88/2021): professional diligence means increased care and skill which a trader may reasonably be expected to exercise towards consumers in business operation, commensurate with good business customs and the principle of good faith (Art. 5, para. 1, point 15). It remains unclear what level of professional diligence should be performed to be proportionate to good business customs and the principle of good faith. Bearing in mind that there are two degrees of professional diligence in accordance to which traders are obliged to act (due dilligence of a prudent businessman and due duligence of an expert), doctrinal view speaks in favor of the due duligence of an expert. That means that the trader is obliged to apply an increased level of due diligence, to adhere to the relevant professional and customary rules (Jovičić, p. 591). If we accept this justified doctrinal view, it remains unclear how the rules of the profession can be brought into some proportion to business morality and the principle of good faith and fair dealing.

with regard to the product of the average consumer whom it reaches or to whom it is addressed, or of the average member of the group when a commercial practice is directed to a particular group of consumers (Art. 5 para. 2). In contrast to UCPD, UTPD determines the general clause by two different elements: first, it must be a practice which deviates from good commercial conduct or which is contrary to good faith and fair dealing,[12] and second, that it is a matter of a practice unilaterally imposed by one trading partner on another (Art. 1, para. 1). Basically, behind the above elements are the basic principles of property law. When one party imposes something unilaterally on the other, it thereby violates the principle of equality of parties in contractual relations, which is based on the will of the parties, that must be equal and coordinated (Commentary about Law on Obligations, p. 107). If a party that violates the principle of equality imposes a practice that violates the principle of acting in accordance with good business practice or the principle of good faith and fair dealing, there is an unfair practice. Given that the existence of unfair practices requires a violation of the basic principles of property law, it seems justified that, if the method of enumeration is accepted, some other principles should be stated in the general clause. Such approach was taken, for example, in the Draft Law on Prohibition of unfair trade practices in the food supply chain of the Republic of Croatia, where it is determined that: unfair commercial practices are contractual provisions and/or business practices which unilaterally impose the buyer to the supplier, regarding the sale of agricultural and food products, using its significant bargaining power in relation to the supplier, contrary to the principle of good faith and fair dealing, the principle of equalilty of parties, the principle of equal consideration as well as contrary to good business practice in the production and/or trade of agricultural or food products (Art. 3, para. 1, item 2).

Different approach has been taken in the directives regarding the standard of protection against unfair practices. UCPD is based on the principle of maximum harmonisation of national regulations with the provisions of the directive. Not only is there a lower limit on the level of legal protection that Member States have to provide, but also an upper limit, which means that Member States are not allowed to set up a system that provides a higher level of protection than required by the directive. A high degree of harmonization, which is achieved by harmonizing national regulations with the rules of the directive, achieves a high general level of consumer protection (Lončar Velkova, Dabović Anastasovska, p. 157; Mišćenić, Mamilović, p. 276; Đurović, p. 173). UTPD adopted the principle of minimum harmonisation which include: a minimum list of prohibited unfair trading practices in relations between buyers and suppliers in the agricultural and food supply chain and minimum rules concerning the enforcement of those prohibitions (Art. 1 para. 1). The minimum harmonisation approach allows Member States to adopt or maintain national rules which go beyond the unfair trading practices listed in this Directive (Preamble, No. 1).

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12 Traditional terms accepted in Serbian law regarding the first element, refer to a practice that is contrary to good business customs (business morality - unwritten but well-known ethical rules on behaviour of market participants) or the principle of good faith and fair dealing.

List of prohibited unfair trading practices

Unfair trading practices, which are listed in UTPD, are characterized by the following: first, they are not exhaustive enumerations, which means that Member States may classify some other practices as unfair; second, all practices are divided into two groups, those that are absolutely prohibited, i.e., considered unfair regardless of the circumstances ("black" practices), and those that are relatively prohibited ("grey" practices), which means that they can be applied if, under clear and unambiguous conditions, they have been previously agreed under a supply contract or a subsequent contract concluded between the supplier and the buyer (the principle of autonomy of will applies to these practices, enabling parties to agree on the qualification of a particular practice). The rules on UTPs do not require operators to carry out certain activities, they only prohibit certain behaviour that is deemed unfair (Proposal UTPD, p. 10).

For easier monitoring, absolutely prohibited UTPs can be classified into five subgroups:

1. Practice that violates the rule on the obligation of a written form of supply contract. **-** Although the use of written contracts should not be mandatory, it is considered that written form may help to avoid UTPs (Preamble, No. 23 UTPD). Therefore, suppliers have the right to ask the buyer to conclude a supply contract in writing. The refusal of the buyer to do so is subject to unfair trading practice, which is prohibited (Art. 3, para. 1, point f) UTPD).

Since commercial contracts are, as a rule, informal, in accordance with the rules contained in our General Customs, each party may request from the other party a written confirmation of the orally concluded contract. Such written confirmation may refer not only to the conclusion of the contract, but also to the facts that occur after the conclusion of the contract, and may be important for the contract performance (Goldštajn, p. 111). Knowing that Directive applies to UTPs, which can occur at any stage of the sale of agricultural and food products (before, during or after a sales transaction) (Preamble, No. 15 UTPD), the use of written confirmation in the supply chain of agricultural and food products may avoid UTPs, regardless of the stage of transaction.

2. Practices deviating from the principle of pacta sunt servanda. – Under the principle *pacta sunt servanda* contracting parties are obliged to fulfill their obligations under the conditions determined by the contract.

The principle *pacta sunt servanda* has no absolute effect, which means that under certain conditions contract provisions may be altered (Commentary about Law on Obligations, p. 161). Thus, the content of the supply contract may be altered by the will of the contracting parties, but not unilaterally, by the will of the buyer. Therefore, it is prohibited for the buyer to unilaterally change the terms of the supply agreement for agricultural and food products that concern the frequency, method, place, timing or volume of the supply or delivery of the agricultural and food products, the quality standards, the terms of payment or the prices (Art. 3. para. 1, point c) UTPD). Or, in the case of termination of obligations, under certain conditions they may be terminated

based on a statement of the will of the buyer. The buyer can cancel the order of perishable products, provided that the notice period cannot be shorter than 30 days. Otherwise, the buyer's conduct would be unfair, because it cannot be reasonably expected that the supplier will find another way to use or place these products on the market (Art. 3, para. 1, point b) UTPD). Exceptionally, in justified cases for certain sectors, Member States could set deadlines of less than 30 days.

3. Practices involving certain payments and reimbursement of certain costs. - The following UTPs are prohibited under UTPD:

a) late payments, i.e., payments to the supplier after the expiration of prescribed deadlines (Art. 3, para. 1, point a). - According to the general rules of contract law, the time of payment is determined by the contract and there are three possibilities: payment as soon as the goods are delivered, payment before delivery and payment after delivery. In commercial relations, the rule is that sales are made on credit and, accordingly, the UTPD sets deadlines for payment after receipt of the delivery, i.e., the expiration of the delivery period. Payments that end after the prescribed deadlines are considered late. These payments negatively affect the economic sustainability of the supplier (Preamble, No. 17), which justifies prohibition of such practices.

What will be considered late payment depends on whether or not delivery of products on a regular basis has been agreed, as well as what is the subject of the contract, perishable[13] or some other products. If the contract provides for regular delivery of perishable agricultural or food products on a regular basis, payment is late if it is made later than 30 days (or 60 days for other products) after the end of an agreed delivery period in which deliveries have been made or later than 30 days (or 60 days for other products) after the date on which the amount payable for that delivery period is set, whichever of those two dates is the later. Where the supply agreement does not provide for the delivery of perishable products on a regular basis, payment is late if it is made later than 30 days (or 60 days for other products) after the date of delivery or later than 30 days (or 60 days, in the case of other products) after the date on which the amount payable is set, whichever of those two dates is the later.

Where the buyer sets the amount payable and delivery on a regular basis is agreed, the payment periods shall start to run from the end of an agreed delivery period in which the deliveries have been made; and when no delivery on a regular basis is provided, the payment periods start to run from the date of delivery of agricultural and food products.

The prohibition, related to deliveries on a regular basis, does not apply to payments: made by a buyer to a supplier where such payments are made in the framework of the school scheme pursuant to Article 23 of Regulation (EU) No 1308/2013 (regulates the issue of EU assistance to Member States in terms of supplying children with fruit and vegetable

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13 According to Art. 2, para. 1, point 5 UTPD, perishable agricultural and food products means agricultural and food products that by their nature or at their stage of processing are liable to become unfit for sale within 30 days after harvest, production or processing.

products); made by public entities providing healthcare in the meaning of point (b) of Article 4(4) of Directive 2011/7/EU: under supply agreements between suppliers of grapes or must for wine production and their direct buyers[14] (Art. 3, para. 1. UTPD).

b) the buyer requires payments from the supplier that are not related to the sale of the agricultural and food products of the supplier (Art. 3, para. 1, point d). - Suppliers and buyers of agricultural and food products are free, within certain regulations, to negotiate the conditions under which the sales transaction will be realized, which includes negotiations on the services that the buyer will provide to the supplier. However, if the buyer charges the supplier for payments that are not related to a particular sales transaction, this should be considered unfair and prohibited.

c) the buyer requires the supplier to pay for the deterioration or loss, or both, of agricultural and food products that occurs on the buyer's premises or after ownership has been transferred to the buyer, where such deterioration or loss is not caused by the negligence or fault of the supplier (Art. 3 para. 1. point e). - If the deterioration or loss of the product was not caused by the supplier's fault, in which case he would be liable for the material defects of the product, then the risk of accidental loss or damage to goods until delivery to the buyer shall be born by the seller, and on delivery of the goods the risk shall pass to the buyer (Art. 456, para. 1 of the Law on Obligations). With the delivery, buyer becomes the owner of the goods, and the rule is that the risk of accidental loss or damage to goods is borne by its owner (*res perit domino*). Therefore, if the buyer, contrary to the stated rule, points out the request that the supplier bears the damage, it is an unfair practice, which is prohibited.

d) the buyer requires compensation from the supplier for the cost of examining customer complaints relating to the sale of the supplier's products despite the absence of

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14 Grapes and must for wine production have special characteristics, because grapes are harvested only during a very limited period of the year, but are used to produce wine which in some cases will only be sold many years later. In order to cater for that special situation, producer organisations and interbranch organisations have traditionally developed standard contracts for the supply of such products. Such standard contracts provide for specific payment deadlines with instalments. As those standard contracts are used by suppliers and buyers for multiannual arrangements, they not only provide agricultural producers with the security of longstanding sales relations, but also contribute to the stability of the supply chain. Where such standard contracts have been drawn up by a recognised producer organisation, interbranch organisation or association of producer organisations and been made binding by a Member State under Article 164 of Regulation (EU) No 1308/2013 ('extension') before 1 January 2019, or where the extension of the standard contracts is renewed by a Member State without any significant changes to the payment terms to the disadvantage of suppliers of grapes and must, the late payment provisions laid down in this Directive should not apply to such contracts between suppliers of grapes and must for wine production and their direct buyers (Preamble, No. 19 UTPD). The suppliers of wine can have crucial and determinant role in speed and quality of the development of wine tourism (Stojković, Milićević, p. 60).

negligence or fault on the part of the supplier (Art. 3, para. 1, point i). - By analogy with the previously stated form of unfair practice, emphasizing such a request is prohibited.

4. *Practices of disloyal behavior of the customer (unlawful acquisition, use, disclosure of trade secrets).* – Businesses, irrespective of their size, value trade secrets as much as patents and other forms of intellectual property right. They use confidentiality as a business competitiveness tool (Preamble No. 2 of Directive 2016/943/EU). The unlawful acquisition, use or disclosure of a trade secret compromises legitimate trade secret holders' ability to obtain first-mover returns from their innovation-related efforts (Preamble No. 4 of Directive 2016/943/EU). The unlawful acquisition, use or disclosure of a trade secret by a third party could have devastating effects on the legitimate trade secret holder, as once publicly disclosed, it would be impossible for that holder to revert to the situation prior to the loss of the trade secret (Preamble No. 26 of Directive 2016/943/EU). This is the reason why practice of the buyer to illegally obtain, use or disclose business secrets of suppliers in the sense of EU Directive 2016/943 is considered unfair and prohibited (Article 3, paragraph 1, item e).[15]

5. *Practices aimed at causing fear of suppliers.* - Fear of suppliers is caused by the so-called. measures of commercial retaliation.　　　　When the buyer threatens the supplier by applying measures (e.g. by delisting products, reducing the quantities of products ordered or stopping certain services which the buyer provides to the supplier such as marketing or promotions on the suppliers' products), if the supplier exercises its contractual or legal rights, including by filing a complaint with enforcement authorities or by cooperating with enforcement authorities during an investigation, it is a matter of commercial retaliation, i.e., a form of unfair trading practice, which is prohibited (Art. 3, para. 1, item h).

According to UTPD, unfair practices will be considered relatively prohibited in case:

(a) the buyer returns unsold agricultural and food products to the supplier without paying for those unsold products or without paying for the disposal of those products, or both; (b) the supplier is charged payment as a condition for stocking, displaying or listing its agricultural and food products, or of making such products available on the market; (c) the buyer requires the supplier to bear all or part of the cost of any discounts on agricultural and food products that are sold by the buyer as part of a promotion; (d) the buyer requires the supplier to pay for the advertising by the buyer of agricultural and food products; (e) the buyer requires the supplier to pay for the marketing by the buyer of agricultural and food products; (f) the buyer charges the supplier for staff for fitting-out premises used for the sale of the supplier's products.

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15 The Law on Trade (Off. Gazette RS, No. 52/19) stipulates that the actions of a trader aimed at acquiring, using and disclosing a trade secret without the consent of its owner, in order to aggravate his position on the market, are considered unfair competition (Art. 41, para. 1, point 4).

Practices, that require a certain payment or bearing of cost, will be classified fair, if the payment is based on objective and reasonable estimates (Preamble, No. 26, 27 UTPD). In this regard, the buyer shall provide the supplier with an estimate in writing of the payments per unit or the overall payments, whichever is appropriate, as well as to provide, in writing, an estimate of the cost to the supplier and the basis for that estimate (Art. 3, para. 3 UTPD).

Protection against unfair trading practices

Unlike the solution adopted in UCPD, where Member States may opt for judicial or administrative protection of consumers from unfair commercial practices, UTPD adopted an administrative type of protection of suppliers from unfair trading practices. The reason behind such approach should be sought in an effort to provide an effective system of supplier protection, and this can only be done by removing the initial obstacle for initiating protection proceedings: fear of commercial retaliation (termination of business relation)[16] against complainant, if suppliers initiate proceedings themselves, and the financial risks involved in challenging such practices (Preamble, No. 8 UTPD).

Member States may designate one[17] or more competent authorities[18] to deal with UTPs (Art. 4, para. 1 UTPD). The competent authorities may initiate and conduct investigations on their own initiative or on the basis of a complaint of producer organisations, other organisations of suppliers and associations of such organisations, which is submitted at the request of one or more members of their member organisations. If the complainant so requests, the enforcement authority shall take the necessary measures for the appropriate protection of the identity of the complainant and for the appropriate protection of any other information in respect of which the complainant considers that the disclosure of such information would be harmful to the interests of the complainant or of those members or suppliers. The complainant shall identify any information for which it requests confidentiality (Art. 6, para. 1, point a; Art. 5, para. 2 and 3 UTPD). This rule is an important element for removing the fear of initiating proceedings.

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16 The weaker party in the food supply chain is often afraid that initiating proceedings could lead the stronger party (buyers, processors and traders) to terminate the business relationship and therefore refrains from action (http://www.agroservis.rs/nepostene-trgovacke-prakse; https://petir.eu/novosti/poljoprivrednici-se-boje-prijaviti-nepostene-trgovacke-prakse/)

17 Member States have appointed different national enforcement authorities to address UTPs: the national competition authority or a dedicated body, such as a national ministry, a national food agency, or a national anti-fraud agency (Report UTPs, p. 6).

18 In the Republic of Slovenia, the Food Supply Chain Relationships Ombudsman monitors actions by stakeholders in the food supply chain, publishes examples of good business practice on its website, and informs the public thereof in accordance with the regulations governing the protection of personal data and the protection of business secrets (the Agriculture Act, paragraph (1) of Article 61.d). The Ombudsman notifies the Slovenian Competition Protection Agency of any illicit practices in the food supply chain (the Agriculture Act, paragraph (2) of Article 61. d). See: What is the role of the Food Supply Chain Relationships Ombudsman?, https://www.varuhverigehrane.si/eng.

If the competent authority considers that there are sufficient reasons to act on the complaint, that authority is obliged to initiate, conduct and conclude an investigation within a reasonable time. If it is determined that the buyer has violated any of the prohibitions, the competent authority may require the buyer to: bring the prohibited trading practice to an end (Art. 6, para. 1, point d) UTPD)[19]; impose, or initiate proceedings for the imposition of, fines and other equally effective penalties and interim measures on the author of the infringement, e.g. court proceedings (Art. 6, para. 1, point e) UTPD). The competent authority has the power to regularly publish its decisions (Art. 6, para. 1, point f) UTPD), as well as information relating to buyers that have committed infringements (Preamble, No. 34).

Monetary sanctions must be effective, proportionate and dissuasive. In most countries, which have regulations on UTPs, there is a maximum level of fines in absolute terms, but in some Member States fines are calculated as a percentage of annual turnover of the company that applied UTPs, ranging from 0.05% to 10% of turnover. In order to deter traders from engaging in UTPs, penalties should be high enough to outweigh any gain from imposing UTPs and suitable to influence behaviour at company level (should be proportionate to the seriousness of such conduct and its potential harm to victims) (Report UTPs, p. 7-8). The penalties shall be effective, proportionate and dissuasive, taking into account[20] the nature, duration, recurrence and gravity of the infringement (Art. 6, para. 1 UTPD).

Conclusion

The adoption of UTPD ended a ten-year process, which took place in parallel at EU level and within Member States, and resulted in the introduction of minimum standards for protection against UTPs, allowing Member States to provide suppliers with a higher level of protection than the one set out in the UTPD.

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19 In connection with this request, the Croatian Law on Prohibition of Unfair Trading Practices in the Food Supply Chain contains rules which enable buyer to propose certain measures in order to eliminate indications of UTPs. If Croatian Competition Protection Agency accepts the proposal, it issues a decision suspending the procedure towards the buyer. If during the supervision it is determined that the buyer does not adhere to the proposed measures, the Agency issues a decision on renewal of the procedure, whereby the buyer's behavior is taken as an aggravating circumstance when determining the existence of conditions for imposing a fine (Art. 18).

20 According to the Art. 27 of the Croatian Law on Prohibition of Unfair Trading Practices in the Food Supply Chain, the amount of the fine is reduced or increased depending on the existence of mitigating (cessation of unlawful conduct before initiating proceedings, cessation of such conduct within three months from the date of initiation, short duration of violation, good cooperation with the competent authority conduct of the procedure, contracted unfair practice was not applied to the supplier) or aggravating (repeating procedures that violate legal provisions, refusing to cooperate with the competent authority, encouraging others to violate legal rules, not acting in accordance with the decision to accept obligations, preventing unannounced control of circumstances).

The legal analysis of the rules, from the general clause to particular forms of UTPs, shows that some of the basic and specific rules of contract law can be identified in the basis of these rules, and that suppliers had the opportunity, even before the adoption of UTPD, to protect themselves against unfair practices in court proceedings with the application of the relevant rules of contract law. However, what makes the adoption of this Directive justified is the fact that contract law, insofar as it encompasses this practice, is not the best mechanism to help suppliers obtain protection. The reason for that is the presence of fear that by filing a lawsuit, they could jeopardize the business relationship with the other party, and thus their own business. In this way, the "fear factor" is eliminated, by ensuring the confidentiality of complaints and conducting the procedure of administrative protection at the initiative of the competent authorities or at the request of relevant organizations and associations.

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Conflict of interests

The authors declare no conflict of interest.

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Indicators	Period			Total
	Month 1	Month 2	Month 3	
Distance crossed (km)	12.926	11.295	13.208	37.429
Fuel consumption (litre)	3.231	2.823	3.302	9.356
Value of fuel consumption (RSD)	242.378	211.790	247.653	701.821
Total time spend on touring (hour)	314	266	417	997
Value of total time spend on touring (RSD)	47.048	39.890	62.570	149.508
Number of tours	98	77	102	277
Toll value (RSD)	0	0	0	0
Number of pallets transported (piece)	1.179	976	1358	3.513
Total weight transported (kg)	602.600	429.225	711.116	1.742.941
Vehicle maintenance costs (RSD)	203.858	164.970	224.806	593.634
Lease costs (RSD)	480.938	454.214	565.784	1.500.936
Total sum (RSD)	974.222	870.864	1.100.813	2.945.899

Source: Petrović, 2012

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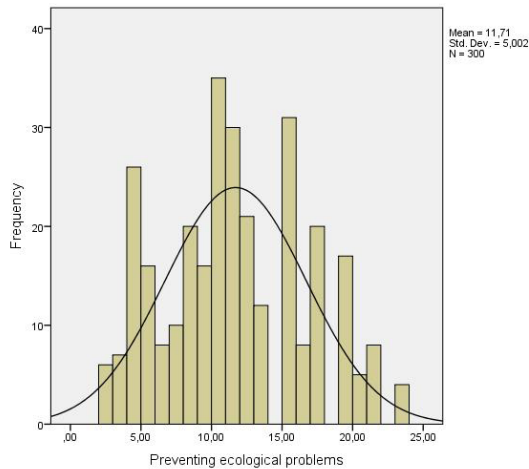
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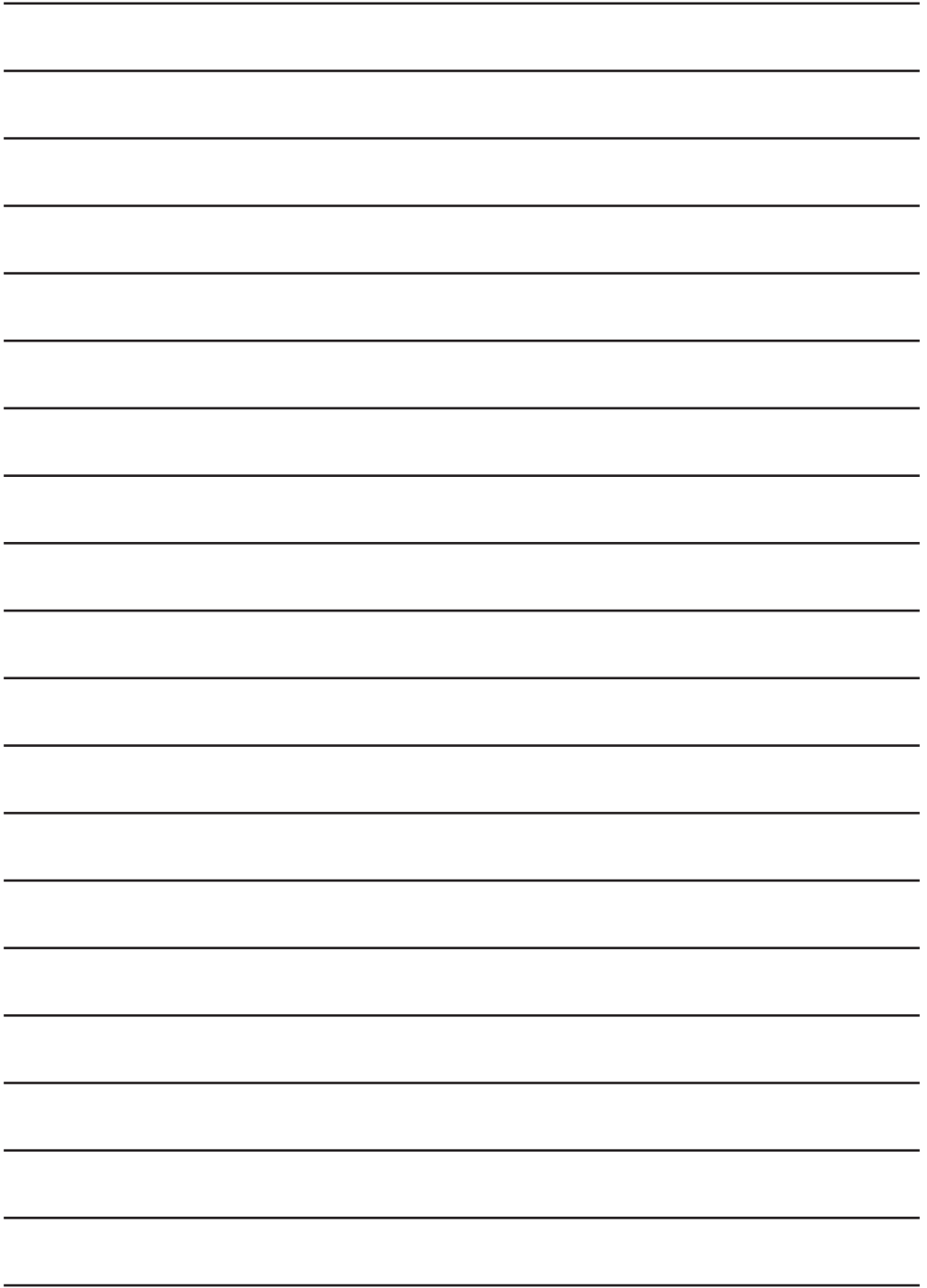
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