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Institute of Agricultural Economics, Belgrade, (Serbia)
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Academy of Economic Studies, Bucharest (Romania)

Адреса уредништва / Editorial office
Београд, Волгина 15; тел/факс (+381)11/6972-848; E-mail: economicsofagriculture@ea.bg.ac.rs
Belgrade, Volgina 15; phone/fax (+381)11/6972-858; E-mail: epoljoprivrede@gmail.com

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ECONOMICS OF AGRICULTURE

CONTENT

THE STRATEGIC ROLE OF NITRATES TO SOIL PERFORMANCE AND CARBON SEQUESTRATION

Lavinia Popescu[1], Adela Sorinela Safta[2], Dumitru Nancu[3]

**Corresponding author E-mail: popesculavinia14@stud.ase.ro*

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ABSTRACT

The aim of this research is to highlight an image of the risks of nitrates and soils but also of the global capacities to adapt to a sustainable agricultural economy. The article also focused on the ability to implement methods of proper use of nitrates to improve soil capacities as a means of sequestration of C. Productivity of crops with a high capacity to fix nitrogen in the soil contributes to the fulfillment of the mitigation mechanism and reduction of greenhouse gas emission. The main result of the research is the identification of adequate nitrate management in improving soil quality, as well as the use of crop rotation as a means of sequestering C at soil level. Methodologically, the conditions for optimizing the capture of C from the soil by adequate management of nitrates were followed. Research will help to understand the problems of land use in the context of climate change, as well as provide information on GHG emissions by advancing strategies that contribute to the effort to decarbonise agriculture through the proper treatment of agricultural land.

Introduction

Agriculture has a unique and important contribution to the economy and to the value of productivity, but low-carbon strategies in this area are often left out of planning. However, the distinct opportunities and challenges in agriculture make the transition to decarbonisation and alignment with environmental targets to be supported as a particular challenge. The ecological transition can contribute to bringing many benefits as well

1 Popescu Lavinia, PhD Student, Doctoral of Economic School, Bucharest University of Economic Studies, Bucharest, Romania, Phone: +40749151272, E-mail: popesculavinia14@stud.ase.ro, ORCID ID (https://orcid.org/0000-0003-2545-7739)

2 Safta Adela Sorinela, PhD Student, Doctoral of Economic School, Bucharest University of Economic Studies, Bucharest, Romania, Phone: +40722221008, E-mail: saftaadela19@stud.ase.ro, ORCID ID (https://orcid.org/0000-0002-8321-2636)

3 Nancu Dumitru, PhD Student, PhD Student, Doctoral of Economic School, Bucharest University of Economic Studies, Bucharest, Romania, Phone: +40747010001, E-mail: nancudumitru12@stud.ase.ro, ORCID ID (https://orcid.org/0000-0002-8321-2636)

as environmental challenges in the conditions of a transition that involves a sustainable agri-food sector with ecosystem services.Net carbon sequestration on agricultural land might offset 4% of yearly global GHG emissions caused by the rest of the century, contributing significantly to the Paris Agreement's goals.

To fully realize the agricultural sector's potential to contribute positively to the sustainability agenda, careful monitoring of carbon stocks in the soil is required, as well as an understanding of what factors contribute to the loss of soil capacity, such as erosion, fertilizers, and non-compliant practices. Solutions to limit carbon loss from the soil would be included in such a strategic panel, which would encourage "win-win" solutions. The latter will need to keep coming up with new ideas for analyzing alternative techniques to resolve concerns about soil sequestration capability. Adaptation to climate change has become one of the cross-cutting objectives to be pursued by all Member States, through all measures to support agriculture as highlighted in (Frelih-Larsen and Bowyer, 2022).

Sustainable land management has been a key strategic priority for the EU and not only in recent years. The factors of choice must first understand what is not being done correctly and the consequences of each decision to use the land in order to better manage the land. Climate change is causing, among other things, an increase in global temperature, variations in the length and frequency of the seasons, and the incidence of extreme weather events. Several sectors of the economy produce greenhouse gas (GHG) emissions, including agriculture, which has become increasingly important in recent years.

In terms of the agricultural economy, it is necessary to prioritize action behavior in terms of agricultural sector vulnerabilities that we cannot predict, such that deepening these aspects supports agricultural orientation through climate change risk reduction measures.

Carbon sequestration contributes to the broader objective of reducing atmospheric greenhouse gas concentrations. One of the most important objectives in the realm of agriculture and rural development is reducing greenhouse gas emissions from the agricultural sector. There is evidence that organic farming has, in theory, a lower carbon footprint per ton of food produced than conventional agriculture because it does not use chemical fertilizers and pesticides. Prioritizing an action behavior in terms of vulnerability encourages ecologically beneficial agriculture practices. The focus is on the possibility of making an ecologically responsible industrial model easier to adopt and promote. We tried to underline problems that we feel are critical for the agriculture sector's development as a part of the economy throughout the file.

The research looks at the idea that carbon absorbers are equally as essential as reducing emissions and that the two are inexorably linked. As a result, a thorough knowledge of soil quality, as well as the preservation and improvement of natural absorbents found in agricultural soils, may be necessary. The research focuses on fertilization modifications depending on acid, neutral, and alkaline soil quality and texture.

The research focused on identifying aspects that may be used to optimize agriculture's

decarbonization potential and promote an ecologically responsible agricultural strategy. While soil quality is being looked at, studies on correlations discovered through enhancing carbon dioxide storage at the farm level and environmental needs at the farm level will be strengthened. By managing the land and modifying its usage, the idea of carbon storage in the soil may be a way to regulate climate change for agriculture. In this study, we examine the potential for modifying the approach taken to measure carbon changes in soil. The data was given by FAOSTAT and the Romanian Institute of Statistics.

Materials and methods

The research focused on identifying aspects that may be used to optimize agriculture's decarbonization potential and promote an ecologically responsible agricultural strategy. When estimating greenhouse gas emissions from agricultural operations, the method for calculating the contribution of nitrogen from organic sources is essential. Simultaneously, investigations on correlations identified by improving carbon dioxide storage at the farm level and environmental needs at the farm level will be strengthened, all while soil quality is examined.

Studies that identify the type or types of soil on the farm, as well as the main morphological and physico-chemical properties relevant to providing maximum fertilization efficiencies and lowering the risk of groundwater pollution with nitrates (and possibly phosphorus), will be taken into consideration in the calculation method for nitrogen inputs from organic sources (slope, texture and soil permeability, degree of saturation in bases). The level of soil fertility, the need for possible improvement measures, and the most appropriate cultivation technologies in terms of soil works, date sowing, organic and mineral fertilizer application methods, and so on, can all be determined using this information, which is correlated with that obtained from agrochemical mapping. We focused on the use of fertilizers in soil based on crops to strategically assess the reduction of greenhouse gas emissions from agriculture, but we also noted the limitations of correspondence between nitrate levels in productive and unproductive soil owing to a lack of field crops.

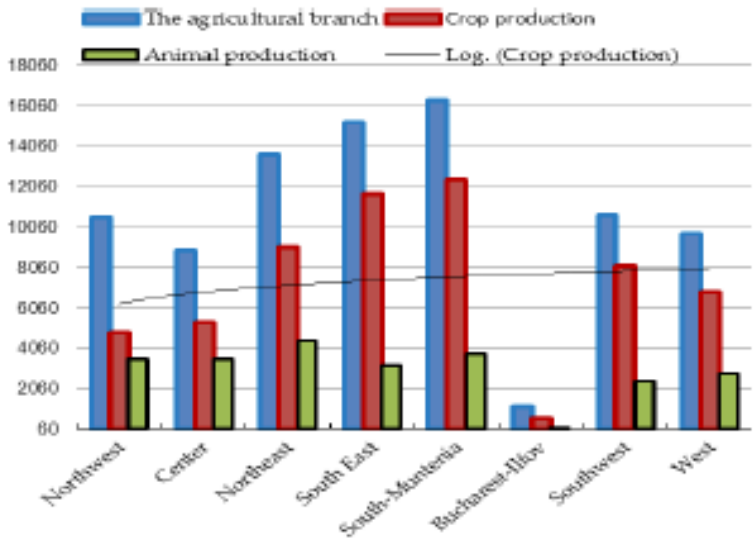
This enabled a preliminary assessment of sustainability as well as a forecast for 2030, when greenhouse gas emissions are expected to fall. We used data from FAOSTAT's four land use categories to conduct the emissions study. To gain a better understanding of Romania's predicament, we looked at the evolution of land use emissions through time and space. Owing to the non-completion of the 2020 census due to pandemics, data on land use may be scarce. Simultaneously, studies on interactions will be improved by increasing carbon dioxide storage on farms and ensuring that environmental criteria are met on farms.

Agriculture and climate issues

Although many promising mitigation strategies have been proposed to reduce GHG emissions, less effort has been focused on adopting such farm management practices from an economic perspective (De Pinto et al, 2010; McCarthy et al., 2011)In other

words, if a practice is not economical, its adoption would be low because farmers would not be stimulated to adopt it (Oster and Wichelns, 2003; Kulshreshitha et al., 2015).[23,24] However, several studies have examined a variety of barriers, including the potential risk of losing performance, the cost of learning, so a decision support system will be useful for analyzing scenarios and promoting farmers' adoption of mitigation practices. GES. Agricultural activity produces greenhouse gases (GHGs), but it also works as an absorbent, storing CO_2 in organic matter and biomass in the soil. In Romania, land abandonment has become more prevalent recently, which has led to a decline in biodiversity. Since 2005, the amount of uncultivated land has increased by 50%, making about 7% of the nation's total agricultural area (952 000 hectares) (2010). Affected ecosystem services by the abandonment of agricultural land include increased carbon storage, decreased soil erosion, improved water quality, and the disappearance of traditional cultural landscapes. Agriculture in Romania is low-productive, and rural regions are disproportionately impoverished. The high proportion of small agricultural holdings is a major contributor to low productivity. Figure no. 1 shows the location of agricultural farms in development regions, comparing the growth of agricultural productivity of plantations to that of farms that produce animals. Plant protection products have also increased in the South Muntenia regions, specifically the South East and Northeast, while there has been a modest increase in livestock and a decline in the consumption of plant protection products in the West.

Figure 1. Agricultural systems by branches in Romania



Source: Owner recherché from data * European Environment Agency (EEA)

Future climate changes will require the sector to plan for adaptation in addition to reducing Green House Gas (GHG) emissions. Greenhouse gas emissions in 2019, by type of gas, expressed in CO2 equivalent are shown in Table 1.

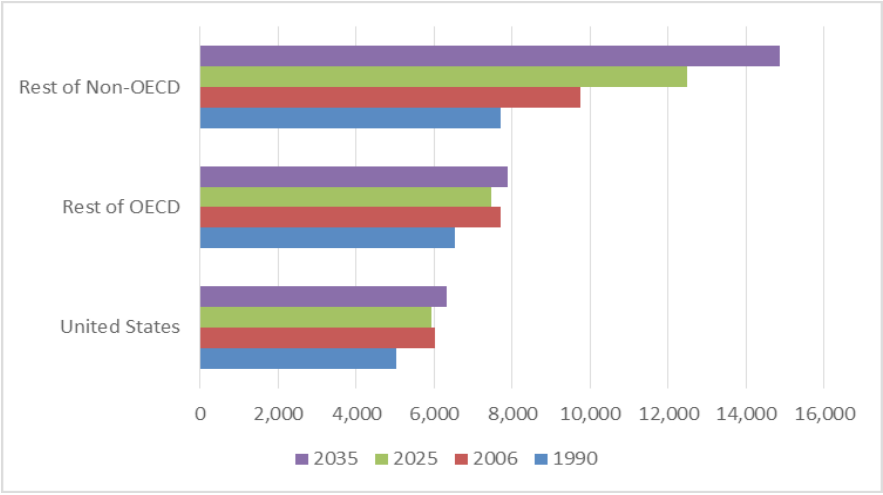
Table 1. The Greenhouse gas emissions

Gas type	Proportion
CO2	82,14%
CH4	10,14%
N2O	5,11%
HFC	2,35%

Source: OECD report

In 2019, the EU28's greenhouse gas emissions were broken down into major source sectors. In 2019, energy is responsible for 79.9 percent of greenhouse gas emissions in the EU28, with transportation accounting for around a third. Agriculture contributes 9.69 percent of greenhouse gas emissions, industrial processes and product consumption 7.86 percent, and water management 2.74 percent. Figure 2 depicts a timeline of carbon dioxide emissions since 1990.(billion metric carbon dioxide)

Figure 2. World carbon dioxide emissions by region, 1990,2007,2025 and 2035

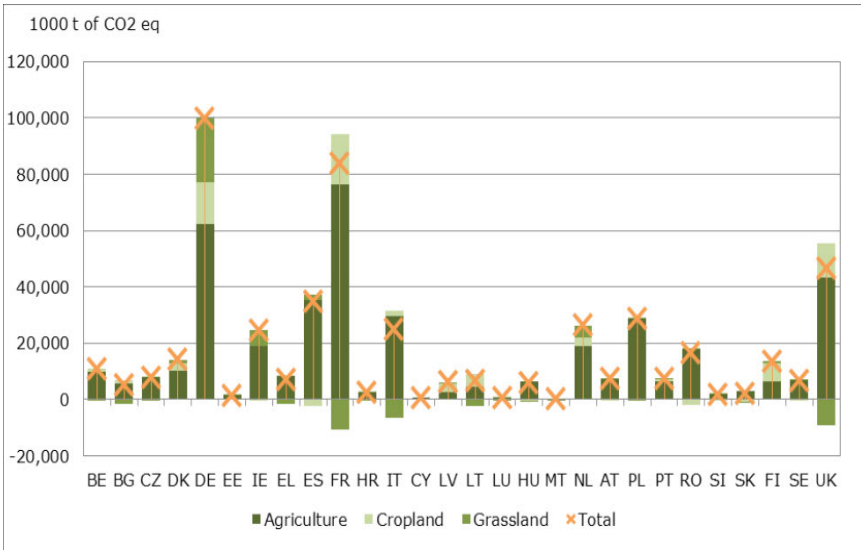


Source: OECD report

Agriculture and forestry, unlike other economic sectors, have the potential to fix carbon in the atmosphere through photosynthesis and store it in soil and biomass, allowing them to absorb emissions. Pastures, wetlands, and forests, in particular, have the capacity to fix huge amounts of carbon.

Carbon stocks, on the other hand, may be lost as a result of changes in land use (deforestation, pasture plowing, wetlands draining, and so on) or extreme weather events (storms, fires, and so on), resulting in the fast release of carbon stored in the atmosphere in the form of CO2. Compared to grassland and wild vegetation, LUCAS research in 2015 found that cultivated land has much lower levels of organic carbon in the soil. About 75% of all agricultural land in the European Union has less than 2% organic content.(Figure 3)

Figure 3. Agricultural land with organic carbon in the soil (UE)



Source: LUCAS report

To support the potential for soil sequestration, a wide variety of tools with best agricultural practices and applications are available.

Adopting hidden crops, for example, can provide benefits not only in terms of carbon accumulation, but also in terms of contributing to the reduction of solar erosion and, consequently, CO_2 emissions (Poeplau & Don, 2014). However, different tillage methods can have different effects on the amount of organic carbon in the soil, depending on the extraction conditions and the depth of the soil. However, two fundamental limitations of carbon sequestration remain: Carbon sequestration practices improve carbon storage until a new balance is reached.

There are three main sources of emissions: animal husbandry, agricultural production and the manufacture of agricultural production factors. The "emissions-absorption" balance reflects the efficiency of holdings in terms of GHG emissions.

Agriculture and forestry, unlike other economic sectors, have the ability to fix carbon in the atmosphere through photosynthesis and store it in soil and biomass, allowing them to absorb emissions. Pastures, wetlands, and forests, in particular, have the ability to fix huge amounts of carbon.

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It is crucial that there be improved agricultural systems that make efficient use of nutrient resources, increasing not only the amount of carbon in the atmosphere but

also biodiversity and agricultural resistance to climatic changes. Typically, adapting a certain agricultural activity can increase carbon stocks in agricultural soil. Additionally, studies show that carbon dioxide absorption is just as important to reducing emissions. To achieve a sustainable environment, it is vital to take into account the way the land is used, changes to its structure, the kind of crops that are grown, and the size of defrişures. All of these factors contribute to the improvement of the soil's quality. It is crucial to maintain and improve the natural wetlands composed of agricultural fields and coastal buffer zones. (Henderson and Lankoski, 2021).

The impact of agriculture on GHG emissions can also be estimated at the farm level, with the balance of emissions accounting for GHG emissions (carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) on the one hand, and CO_2 uptake (carbon credits) due to carbon sequestration in the soil and energy production from renewable sources and biomaterials on the other.

Animal husbandry, agricultural output, and the fabrication of agricultural production elements are the three main sources of emissions. In terms of GHG emissions, the "emissions-absorption" balance demonstrates the efficiency of holdings. Modeling can be used to estimate the influence of climate change on agriculture. Climate change has a bidirectional effect on production: it can have divergent consequences (an increase or decrease in output) that are highly dependent on regional conditions.

Increased temperature, drier summers, milder and rainier winters, intensification of extreme weather events with a significant impact on soil erosion (floods, droughts, etc.) and, indirectly, increased CO2 content in the atmosphere, which promotes photosynthesis, are some of the potential consequences. In many ways, the agricultural sector must adapt to climate change.These include, for example, the selection of species and varieties, the adaptation of agricultural work to the calendar (a greater degree of flexibility), the adaptation of agricultural production practices (fertilization, plant protection, irrigation, etc.) or the adoption of plant production that results in an increase in the soil's organic matter content or the soil being covered with plants. The latter seeks to reduce soil erosion. Reduced indirect N_2O emissions and the use of nitrogen-based mineral fertilizers can also help to reduce GHG emissions.

In terms of emissions, soil qualities, climate, and crop management are all important factors to consider. On the other hand, the accomplishment of this goal will be tracked by keeping an eye on the areas where green crops were planted and measuring how much plant biomass was generated as a result of afforestation. Most agricultural soils lack enough natural nitrogen to meet the needs of crops throughout the growing season. Soil's naturally existing nitrogen must therefore be replaced annually. The application of the correct amount of nitrogen at the right time is a must for successful fertilizer strategy.

The impact of climate change on agriculture can be estimated by modeling. Climate change affects production not only unidirectionally: it can have divergent effects (increase / decrease in production) that largely depend on regional conditions.

The effects can be increased temperature, drier summers, milder and rainier winters, intensification of extreme weather events with a significant impact on soil erosion (floods, droughts, etc.) and, indirectly, increased CO2 content in the atmosphere, which promotes photosynthesis. The agricultural sector needs to adapt to climate change in many areas.

These include, in particular, the selection of species and varieties, the adaptation of agricultural work to the calendar (a greater degree of flexibility), the adaptation of practices used in agricultural production (fertilization, plant protection, irrigation, etc.) or the adoption of plant production leading to an increase in the organic matter content of the soil or to the soil being covered with plants. The latter aims to slow down soil erosion

Reducing GHG emissions can also be achieved by reducing indirect N_2O emissions and using nitrogen-based mineral fertilizers.

In terms of emissions, soil qualities, climate, and crop management are all important factors to consider. The success of this goal will be evaluated by keeping an eye on the areas that were planted with green crops as well as the volume of plant biomass created through afforestation. The amount of harvestable nitrogen that can be obtained under a specific set of pedoclimatic and technical conditions varies greatly between crops, and even within the same crop. Only optimum circumstances, which are achieved when the components described above generate optimal conditions for plant growth and development, can a crop's genetically determined production potential be realized.

A helpful agricultural technique is to tailor fertilization and fertilizer timing to the kind of agricultural crop and soil characteristics. The nitrogen need is determined by the soil's nutrient reserve, local weather conditions, and the expected amount and quality of production.

Strategic option

Around 1.6 Gt of Cyr-1 emissions were estimated to have been produced globally by land use and land use change in the 1990s, accounting for close to 33% of the carbon dioxide emissions between 1950 and 1998. This was mostly due to deforestation (Watson et al., 2000). [19] Agricultural emissions made up 10% of all GHG emissions in the EU between 1990 and 2020, compared to over 20% of GHG emissions across all sectors in Romania, showing a downward trend for the EU as a result of CAP efforts to promote growth and protect the environment. In the case of Romania (Zaharia & Antonescu, 2014), the tendency is mostly attributable to unregulated fertilizer and pesticide use.

The form in which soil carbon inventory is stored, as well as the capacity, persistence, and bulk density of the soil, as well as the textural class of the soil, all play a role in land management for carbon sequestration. In some areas, particularly on soils with a thin limestone bedrock, groundwater contamination is a severe concern. Depending on the local circumstances, this danger should always be considered when applying organic fertilizers in high-risk areas. When estimating greenhouse gas emissions from

agricultural operations, the method for calculating the contribution of nitrogen from organic sources is essential. Crops can only use organic nitrogen once it has mineralized or broken down into inorganic nitrogen in the soil.

The ratio of carbon to nitrogen in fertilizer (C/N) is the most important evolution factor for crystalline forms of nitrogen. Mineral fertilizers, such as nitrogen (N) and phosphorus (P), are particular minerals that are absorbed from the soil of plants to help them grow, and are used to enhance agricultural productivity. As a result, an excess of either nitrogen or phosphorus causes contamination in the environment, such as eutrophication of surface water. As a result, reducing the overuse of mineral fertilizers is important. Improper fertilizer management (natural or chemical) can cause substantial environmental and health issues (eutrophication, a condition that adversely disrupts the equilibrium of aquatic ecosystems). A classification of fertilizer products is presented in Table 2.

Table 2. Fertilizers the chemical composition used

FERTILIZER	N(%)	P_2O_5(%)	K_2O(%)
Nitrogen fertilizers			
1. Ammonium sulfate $(NH_4)2SO_4$	21		
2. Calcium nitrate $Ca(NO_3)2$	16		
3. Ammonium nitrate NH_4NO_3	34		
4. Calcium and ammonium nitrate NH_4NO_3 + $CaCO_3$ (CAN)	27		
5. Urea $CO(NH_2)2$	46		
Phosphorus fertilizers			
1. Simple superphosphate (SSP), $CaH_4(PO_4)2$+ CaHPO4· $2H_2O$		16-18	
2. Triple superphosphate (TSP), $Ca(H_2PO_4)2$+ CaHPO4		46	
3. Phosphate rock (PR), activated or not		22-40	
3. Phosphate rock (PR), activated or not	18	46	
3. Phosphate rock (PR), activated or not	11	48	
Potassium fertilizers			
1. Potassium chloride (MOP), KCl			60
2. Potassium sulphate (SOP), K2SO4			50
3. Potassium nitrate, KNO3	13		44
Complex fertilizers			
1. NPK	15	15	15
2. NPK	17	17	17
3. NPK	22	22	11

Source: ICPA

Denitrification and ammonia volatilization on the surface of alkaline soils are two processes that might cause these losses. Nitrogen is a nutrient specialized to plants and may be present in natural organic fertilizers in different proportions, primarily as protein from animal feces. The capacity to control fertilization according to vegetation, culture, agrofond, and nutritional deficits, as well as improved cost-efficiency indicators for extraradicular and liquid fertilizers, all led to the quick development of fertilization methods and technology. A helpful agricultural technique is to tailor fertilization and

fertilizer timing to the kind of agricultural crop and soil characteristics. The nitrogen need is determined by the soil's nutrient reserve, local weather conditions, and the expected amount and quality of production.

The Table no.3 above shows evaluations fertilizer unit kgN/ha or kg P/ha cost from, 2015 to 2019 from CRAAQ [7]

Table 3. Fertilizer unit(kgN/ha or kg P/ha

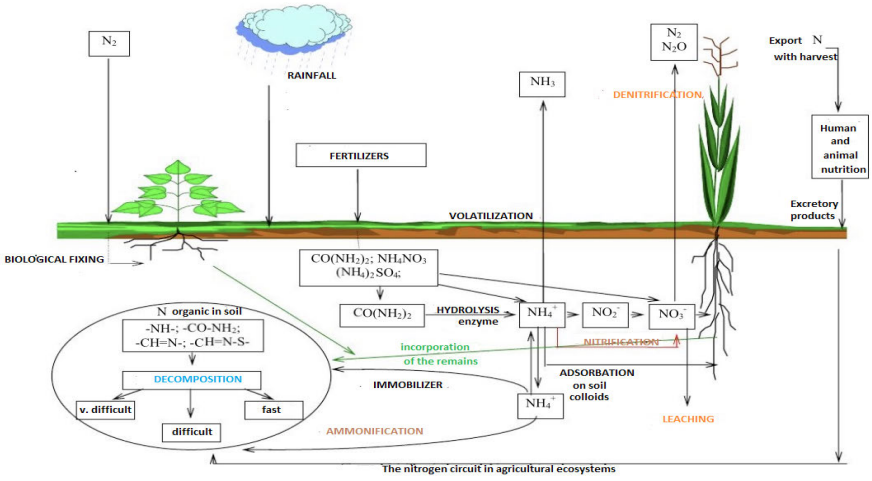
Fertilizer type	Nutrient content	2015	2016	2017	2018	2019
Calcium ammopnium nitrate	27-0-0	701	670	606	608	678
urea	46-0-0	780	702	654	665	735
Phosphate triple	0-46-0	1010	990	965	926	1013
Phosphate ammoniacal	18-46-0	911	910	822	840	930
Phosphate monomaniacal	11-52-0	905	945	833	793	N/A
Muricate de postassium	0-0-60	794	690	645	650	726

Source: Data extract from *CRAAQ*

Liquid fertilizer A-320 (0-45-34) (URAN) with a content of 32 percent nitrogen contains all three types of azote (ammoniacal, nitric, and amidic) and is applied during planting by soaking a date in irrigation water. This method of application has the advantage that the dosage of azot (active substance) can be divided into two to five stages, depending on the vegetative phase. Other versions used include the A 160 (0-46-0), A 200 (0-57-0), and A 280. (0-39-30).

For example, those with a high P_2O_5 content are more suited to presown grain cereals, while those with a high nitrogen ratio are better suited to technical crops, and so on Figure 4.

Figure 4. The nitrogen agricultural ecosystems



Source: incpe

Soil qualities impact fertilizer application: on heavy soils, more fertilizer may be applied than on light soils; on acid soils, fertilizers with an alkaline physiological response are used, while on alkaline soils, fertilizers with an acid physiological reaction are used.

To maximize crop nutrient uptake while limiting the usage of organic fertilizers, the times when they should be administered should be determined as early as possible throughout the crop growth cycle, taking into account a variety of factors. Only one crop is harvested per year on badly degraded meadows, whereas two or three harvests are produced on other meadows, with the first harvest having the maximum weight. Organic fertilizers used to permanent pastures (pastures and meadows) may not exceed a dose of 170 kg nitrogen per hectare per year and must not be administered during the restriction periods.

Schmidt (2008) focuses on the transition from natural to cultivated land. Cropland, grassland, and marshes have all been widely examined. However, because these methods must be managed according to external components based on the periods of soil management with fertilizers, a technical formula cannot be proved accurately. In terms of emissions, soil qualities, climate, and crop management are all important factors to consider. The interactions between crop development, soil carbon, nitrogen demands, and climate are explored in the following scenarios.

Due to the possibility of controlled application based on the development phases, extraradicular and liquid fertilizer fertilization methods and technologies developed quickly. Due to the extremely small amounts of active chemical used, using extraradicular fertilizers as a fertilizing strategy in modern agriculture is also a potential way to develop organic farming. Chemical fertilizers containing organic components and phytoregulatory functions are not covered by Regulation (EC) 2003/2003 on chemical fertilizers, which has been in effect in Romania since 2007.

These products can also be used for organic farming. On the other hand, acid rain, which is typically prevalent precisely in places where there is a large concentration of potential contaminants from over fertilization, magnifies neighboring dangers such as forest deterioration and even destruction.

Results

Human mistake is to blame for the most majority of environmental damage produced by improper fertilizer application. The land use, greenhouse gas emissions are a global phenomenon with serious consequences for the planet. As a result, many studies have focused on assessing land use emissions and their consequences rather than technical soil fertilization and forest curtain procedures. Contrarily, carbon sequencing is a function of ground-level storage, highlighting the significance of evaluating soil quality and interdependence with the climatic ecosystem. However, determining how to correlate the link between reducing emissions in agriculture and adapting to sustainable systems over time is a challenge for small farmers as well as holding companies. Soil is regarded as a strategic carbon store that holds more carbon than the atmosphere and

terrestrial plants combined. The buildup of stabilized carbon in the soil necessitates storage regulation. Furthermore fertilizers, via their influence on microbial activity, plant carbon contributions, and meteorological conditions such as temperature solution.

Carbon sequencing, on the other hand, is a function of ground-level storage, stressing the need of identifying soil quality and climate ecological interaction. Small farmers and holding businesses, on the other hand, face a problem in establishing how to draw the relationship between cutting emissions in agriculture and adapting to sustainable systems over time. Soil is thought to be a strategic carbon store, storing more carbon than the atmosphere and terrestrial plants combined. Storage control is required for the buildup of stabilized carbon in the soil. Fertilizers, which are necessary for agricultural systems to sustain plant productivity, have an influence on the amount and kind of wastes generated by plants. In addition, they have an impact on microbial activity, plant carbon contributions, and climatic circumstances such as temperature.

Alignment with climate change is more than a challenge, but it is also a prerequisite for the development of new ways, such as organic farming practices that do not affect the environment in the long run. There is a need to reconsider priorities for accelerating processes in the agri-environment area in order to foreshadow the implementation of more environmentally friendly agricultural methods, in order to achieve low GHG levels.

Discussions

In recent centuries, the amount of emissions produced by various economic sectors has rapidly expanded all around the world. This increase in emissions has had a devastating impact on the climate of the globe, hurting human society, biodiversity, and all life. The fact that these effects worsen the issue is well known to scientists and governments who are striving to minimize and/or adapt to climate change. How land is used, changes in its structure, shared fertilizers to improve soil quality and the extent of deforestation are all important factors to consider when it comes to achieving sustainable land management by farmers and territorial administrative entities that own land in state ownership.

The distribution of nitrogen in the soil is regulated by organic carbon, vegetation, climate, and soil texture, as can be shown. As a result, land use, as well as novel agricultural techniques based on management built using local data and tailored to agricultural output, may all contribute to improved soil performance.

In our perspective, agricultural areas in general, and particularly those in Romania, have a lot of potential for carbon capture and storage.

Changing some agricultural techniques may generally increase carbon storage in agricultural soils. Carbon absorbers are equally as important as cutting emissions, according to study. Agricultural areas in general, and especially those in Romania, have a lot of potential for carbon capture and storage, in our opinion. Improved agricultural systems that properly use nutrient resources are critical for boosting not only the quantity of carbon in the soil, but also biodiversity and agriculture's resistance to climate change.

Conclusions

As Nancu et al (2022) argue, we could perfect the options for developing agricultural systems as a whole, including both facilitation mechanisms in the agricultural production sector and in forest management, forestry both as potential mitigation levers as solutions. Reducing greenhouse gas emissions is not the sole responsibility of one area and therefore requires the involvement of all factors as a joint effort.Important steps have been taken to reduce emissions by using land, but the consumption of fertilizers still shows that reducing them would be an important indicator in measuring farmers' awareness of crossing the threshold to more environmentally friendly agriculture and reducing fertilizers.

By researching the current state of land resources, the impact of previous land reforms and policies, and by improving land legislation and the function of local government, one can find the pulse of this goal and what needs to be done afterwards.

An essential conclusion from the perspective of greenhouse gas emissions is related to the adaptation of agricultural systems to the conditions of soil management in environmental conditions. Other factors of land use change have been and continue to be the lack of actual procedures for executing the unified agricultural policy in order to fulfill cross-compliance and climate change needs. Both farmers and long-term rural development groups would gain from this. As a consequence, a lack of adaptation of cross-border measures in the CAP program leads to constraints from the perspective of sustainable agriculture and would increase greenhouse gas emissions from the atmosphere while a low emission value is the effect of environmentally friendly use of soil.

Therefore, the soil is at the center of the analysis of emissions from agricultural sources and due to its ability to store carbon in the soil from agricultural practice and crop rotation but also by the way fertilizers work in the soil thus increasing its nutritional value. Extensive discussions have been generated about environmental policy and its adaptation over time, The Paris Agreement practically aims at strengthening a reliable response to climate change by increasing the capacity of all to adapt to the environment. That is why we will state that sustainable for farmers also implies sustainable for the environment, because plants, soil, climate, and biodiversity all contribute to the agricultural system's overall sustainability. In terms of greenhouse gas emissions, the vision of agricultural products to soil management conditions in environmental contexts is a key conclusion. As a result, the CAP program's lack of cross-border adaptation inhibits sustainable agriculture and raises greenhouse gas emissions into the atmosphere, despite the fact that low emission values are the outcome of environmentally friendly soil usage. As a result, the soil is at the center of agricultural emissions analyses, not only because of the way fertilizers work in the soil to improve its nutritional value. Farmers must continuously adjust methods to new difficulties, such as keeping the soil covered and utilizing ways for regulating the land's environment to help preserve carbon in the soil. According to study, changes in land use have an impact on soil carbon.

Agriculture methods that are more ecologically friendly are promoted as a result of the development of an action behavior in terms of vulnerability. The need for agricultural innovation will help to define the requirements for building a viable and highly competitive market economy, as well as to understand the economic and financial implications of carbon storage on the farm. An important component of the research mission is to be both an advantage from the perspective of reconfiguring farm strategies through production methods aware of environmental risks and able to adapt ecological processes, step by step as a partner of responsibility.

Conflict of interests

The authors declare no conflict of interest.

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ANALYSIS OF PRODUCTION AND ECONOMICS OF RAINBOW TROUT FARMING ON TWO CAGE FARMS IN SERBIA AND BOSNIA AND HERZEGOVINA

Stevan Čanak[1], Nebojša Savić[2], Jerko Pavličević[3], Nikola Ljiljanić [4], Robert Radišić[5],

**Corresponding author E-mail: stevancanak@yahoo.com*

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ABSTRACT

The subject of this paper is the analysis of conditions, production and economic results of Rainbow trout production on two cage farms in Serbia and Bosnia and Herzegovina. An analytical calculation of total costs was used to compare the economic results of trout farming. The aim is to compare the achieved production and economic results of Rainbow trout farming in cage farms in Serbia and Bosnia and Herzegovina, and to analyze the influencing factors. The analysis showed minor differences in the natural conditions, production results, and economic results. Both analyzed farms are characterized by strong fluctuations of water temperature during the year. Such natural conditions affect negatively both the production and the economic results of farming. The analysis showed that the production is economically viable on both farms if the value of production is calculated together with subsidies, ie premiums. Without subsidies, the fish farm in BiH is operating at a loss.

1 Stevan Čanak, PhD, research associate, AquaTech Consulting Agency, Belgrade, Serbia, E-mail: stevancanak@yahoo.com, Phone: +381/655576343, ORCID ID (https://orcid.org/0000-0003-2034-0531)

2 Nebojša Savić, full professor, University of Banja Luka, Faculty of Agriculture, BiH, E-mail: nebojsa.savic@agro.unibl.org, Phone: +387/51330950, ORCID ID (https://orcid.org/0000-0003-3638-2197)

3 Jerko Pavličević, full professor, University of Mostar, Faculty of agriculture and Food Technology, BiH, E-mail: pavlicevicj@gmail.com, Phone: +387/36337102, ORCID ID (https://orcid.org/0000-0001-5404-2263)

4 Nikola Ljiljanić, research assistant, PhD candidate, Institute for Science Application in Agriculture, Belgrade, Serbia, E-mail: nljiljanic@ipn.bg.ac.rs, Phone: +381/605118962, ORCID ID (https://orcid.org/0000-0001-7016-5175)

5 Robert Radišić, PhD candidate, Institute for Science Application in Agriculture, Belgrade, Serbia, E-mail: rradisic@ipn.bg.ac.rs, Phone: +381/63491985, ORCID ID (https://orcid.org/0000-0002-7161-1269)

Introduction

On cold-water farms or trout farms in Serbia, Rainbow trout (Oncorhynchus mykiss) is almost exclusively produced as a table species, while brown trout (Salmo trutta), grayling (Thymallus thymallus) and Huchen (Hucho hucho) are occasionally produced for restocking open waters - natural watercourses. Rainbow trout are farmed in Serbia mainly using river and spring water, while farming on lakes is sporadically represented. On trout farms in BiH, as a consumption species most commonly farmed species is rainbow trout (Oncorhynchus mykiss), to a lesser extent brown trout (Salmo trutta) and brook trout (Salvelinus fontinalis). For stocking open waters in BiH, brown trout (Salmo trutta), grayling (Thymallus thymallus), huchen (Hucho hucho) and Neretva soft-mouthed trout (Salmo obtusirostris) are raised. Rainbow trout farming in BiH is mostly done in classic fish farms (concrete race-ways) that are supplied with water from rivers, streams, springs of different capacity (amount of available water), most often from the springing parts of watercourses. Cage farming in water reservoirs (mostly in artificial water reservoirs) has gone through oscillations in the last decade in the number of cage farms, most of which are not registered (Hamzić et al., 2015; Šapić et al, 2019).

Trout farms in Serbia are flow-through by type, and concrete, so-called raceway tanks by type of construction. There are several cage systems (Lake Zaovine, Lake Lisin) but the production on them is small. Based on some estimates (Marković et al., 2009; Radović & Gnjatović, 2021), it is possible to increase the volume of cage farms in Serbia by about 10 times. Bosnia and Herzegovina is characterized by dominant production in classic flow-through trout farms (concrete race-way tanks), trout is sporadically grown in earthen pools. Cage trout farming and the largest production is realized in several cage trout fish farms in water reservoirs on the Neretva (Grabovica and Salakovac), Bilećko Lake and in cages on Žepa.

The sizes of trout farming units can be expressed on the basis of the volume and number of units, as well as according to the production they achieve. According to the amount of annually produced table fish in Serbia, there are fish farms that annually produce less than 100 kg of trout, as well as those whose annual production exceeds 200 tons. Bosnia and Herzegovina is characterized by a large number of rivers, in most cases class I quality, on which a large number of classic, concrete trout farms have been built. Hamzic et al. (2015) present the data that in BiH in 2014 there were about 40 registered trout farms, and according to estimates that number is at least 97, with different annual production. These are mainly smaller fish farms with an annual production of several tons of trout. Large fish farms have a production of over 500 tons per year. According to the completeness of the production process, there are full-system farms that start production with broodstock spawning and semi-systemic farms that start production by purchasing some of the younger trout categories (fry, fingerlings).

Generally speaking, trout production in Serbia is characterized by very large fluctuations in production conditions, the size of farms and the amount of fish produced. In comparison to the surrounding countries, the conditions for trout production can be assessed as acceptable.

The main disadvantage is the lack of sufficient quantities of quality water with stable flows and temperatures during the year. Bosnia and Herzegovina is characterized by high quality mountainous waters suitable for trout farming and increased production, which is evident from the official data on trout production on an annual basis, but due to climate change, significant oscillations of the hydrological regime during the year are evident.

Materials and methods

The data were obtained from Rainbow trout producers based on a structured interview and survey with multi-year averages represented. Data were collected from one Rainbow trout cage farm in Serbia and one in Bosnia and Herzegovina. Data that could not be collected in the described way were calculated and adopted on the basis of average values of other farms. Part of the data from the Republic of Serbia comes from the research of the analysis of the specifics of trout production in mountain lakes (Čanak et al., 2018). The data collected in Serbia derive from the largest cage farm, where about 50 tons of edible Rainbow trout was produced annually, out of a total of about 100 tons of trout produced on cage farms. There are currently a total of 3 cage systems for trout production in Serbia. The total number of cage trout farms in BiH in 2014 was 17 (not all registered), with an annual production of about 155 tons (Hamzić et al., 2015; Rakić et al., 2021). The data collected in BiH come from a cage farm whose annual production is also around 50t, which makes the comparison easier. A special advantage is the fact that in addition to the total production capacities and the breeding capacities themselves are of identical dimensions, each breeding unit has a useful volume of 100 m^3.

Based on the collected data, a comparison of production conditions and achieved production results was performed, and thus the observed differences were analyzed. Using the average values of basic production indicators, as well as other technical information on the observed ponds, the calculation of production costs was performed, and thus an analytical calculation of total costs as well. The comparison of economic effects was made at the level of production cost, economic profit, economic efficiency and profitability of production, both for the case without incentives, so too with the incentives. Subsequent analysis included a sensitive analysis of the impact of the wholesale price of table fish, as well as the amount of incentives on the financial result.

Conditions in which production is performed on the examined ponds

According to available data, production at trout ponds in Serbia was performed on areas in operation between 33255 m^2 and 81411 m^2 during the period 2010-2019 (RSZ, 2020). Out of this area, cage systems occupy about 2,000 m^2 in operation per year, on currently 3 active cage farms. Two are located on Lake Zaovine and one on Lake Lisine. The examined pond in Serbia is located on Lake Zaovine.

Lake Zaovine is located in western Serbia, in the municipality of Bajina Basta and at a maximum water level it has an altitude of 892 m. Lake Zaovine is an artificial reservoir

of reversible type, which means that water is pumped into it and used to operate the hydropower plant as needed.

"Zaovine" fish production facility is a semi-systemic cage pond and on it the production process begins with the purchase of juveniles of different sizes, but usually of about 10 g. At the Zaovine fishpond, production lasts all year round, and during 2020, experimental carp fattening was carried out for the first time.

On Lake Zaovine, the water is class I quality, and is suitable for breeding salmonid fish species. The exception is the high water temperature during the summer months when the diet is completely or largely disabled. Water temperatures reach such high values that the survival of trout is uncertain. Increased water temperature in the surface layer to a depth of 5 m over 18 °C in the cultivation of Rainbow trout entails a reduction or interruption of feeding, which leads to the absence of growth, as well as to the mass weight loss of fish. This phenomenon is very harmful to the economy of the fishpond, due to the existence of fixed costs that burden the financial result of the business, regardless of fish growth.

An additional specificity of the natural conditions on Lake Zaovine are the low temperatures during the winter. Water temperatures below 4 °C last from January to March and then the fish diet is reduced and the growths are very limited.

The direct consequence of the previously mentioned low and high temperatures in trout fattening are the reduced number of feeding days and the extended breeding period until reaching the consumption size. Indirect consequences refer to more frequent illness of fish during the summer period, difficult manipulation of fish, as well as difficult treatment at low and high temperatures.

High water temperatures during the summer make technological operations of grading, transfer to other cages and implementation of medicinal baths more difficult, due to additional stress for fish that are already in suboptimal living conditions. Delivery of table fish is difficult in summer due to mandatory hypothermia below 4 °C. During winter, on the other hand, the catch itself is very difficult due to the freezing of water on all surfaces that are in contact with the air, while the manipulation of fish in order to grade it is completely excluded due to damage to the skin of fish from low temperatures.

Snowfall during the period December-March on Lake Zaovine makes work difficult, primarily due to the impossibility of transporting workers and delivering fish. The existence of ice cover is occasional on Lake Zaovine, it does not happen every year.

Wild animals (otters, herons) which can cause very significant damage to production present the risk in production. Otters are especially dangerous because, in addition to the direct damage to the fish they eat, they can cause much bigger problems if they damage (bite) the cage nets when entering them. The presence of a guard dog on the cage system cannot solve the problem of otter intrusion.

A special trait of trout farming in lakes is the risk of more frequent fish diseases with parasitic diseases, if cyprinid fish species are also present in the lake. With elevated water temperatures, this problem has become even more important, both due to the faster flow of parasitic diseases, and due to the difficult implementation of antiparasitic baths. Only short-term, current so-called "flush" baths are possible on cage systems, the implementation of which requires extensive experience.

Production on classic trout farms in Bosnia and Herzegovina during 2019 was performed on an area of 104,202 m^2 and in cages with a total volume of 87,050 m^3 (Statistics Agency of BiH, 2020). Cage trout farming in BiH is represented on several water reservoirs, with the largest volume of production in water reservoirs formed on the Neretva River (altitude of Mostar reservoir 78 m, Salakovac 123 m, Grabovica 159 m and Jablanica 270 m), Lake Bileća 400 m), the confluence of two rivers in Lake Drina (altitude 250 m). These water reservoirs have quality water for fish farming.

Table 1. Some indicators of production conditions and achieved results on the analyzed farms

Indicator / farm	M1 –Serbia	M2 –BiH
Production capacity (m^2, m^3) in operation	1100; 4400	1400; 5600
Temperature variations during the year (°C)	1–25	1-22
Feed Conversion Ratio for the whole farm (kg / kg)	1.2–1.3	1.0-1.25
Losses during farming from 10 g to table fish (%)	10–30	7-10
Breeding duration (months)	14–16	12-13
Production of fish per unit volume (kg/m3 in the final phase of fattening)	15–20	30
Number of feeding days per year *	cca 270	cca 300

* Number of feeding days for nutrition according to the nutrition table

From *Table 1* it can be seen that the conditions in which the production takes place on the analyzed farms are very similar. There is a difference in water temperature, with the water temperature at the cage farm in Serbia reaching 25 °C, while at the pond in BiH it does not exceed 22 °C. The number of days with high temperatures from 20 °C to 25 °C on the fishpond in Serbia is 15-30 per year. In the cultivation of Rainbow trout, these temperatures are extremely unfavorable and directly affect the increased losses during breeding. Also, these extreme temperatures for trout farming affect a smaller number of feeding days, a longer breeding period and a poorer feed conversion ratio at the fish farm in Serbia compared to BiH. Desirable water temperatures for Rainbow trout farming during the growing season are from 7 ºC to 18 ºC, and are optimal from 14 ºC to 16 ºC (Savić et al., 2009; Woynarovich et al., 2011).

Studies indicate that an increase in water temperature from 19 ºC to 25 ºC leads to a decrease in the amount of feed consumed, as well as a decrease in growth, with the largest decrease at 25 ºC (Myrick, Cech, 2000), which approaches lethal temperatures for Rainbow trout (25 ºC – 26 ºC)., according to some authors (Cherry et al., 1977; Hokanson et al., 1977). Also, the same conclusions were reached by Jiang et al. (2021), that increasing the temperature from 17 °C to 21 °C reduces the amount of

feed consumed and the specific growth rate (SGR), and that elevated temperatures lead to weakened immunity, digestion and growth of Rainbow trout. Also, some recent research suggests that Rainbow trout have a limited ability to mitigate the negative effects of rising ambient temperatures (Coughlin et al., 2020).

Rainbow trout farming capacities are similar in the analyzed farms, where the unit capacities (one cage) are identical and amount to 5 m*5 m*5 m with a useful volume of about 100 m^3. The mass densities of fish in the final phase of fattening are up to 20 kg/m^3 at the farm in Serbia, and up to 30 kg/m^3 at the farm in BiH. Excessive stocking densities can cause a number of negative consequences for farmed fish and production results, such as lower growth rate, higher conversion rate, bad fin condition, more frequent diseases, etc. The stocking densities at both observed farms are generally below the upper recommended limits for cage farms, based on several studies (Ellis et al., 2002), and below the generally recommended (rull of tumb) stocking density for Rainbow trout of 40 kg/m^3 in the final phase (Mäkinen and Ruohonen, 1990).

Economic results of production

Based on the previously presented data from *Table 1*, as well as other normative data, an analytical calculation of the total costs of trout production for defined production conditions can be compiled. Two farms in Serbia and Bosnia and Herzegovina with an annual production of cca. 50 tons were selected for the calculation of economic results. Natural conditions for production and applied production technology are key factors that have a decisive influence on the achieved production and economic results. When defining organizational and economic models, data of special importance for economic results are: size of the tank, time of breeding, average weight of stocked fish, losses during breeding, choice of feed for fattening, number of employees, way of selling table fish, etc. Some of the variable factors can change, so it is necessary to monitor their impact on the economic effects of production (length of farming, size of the tank). It is important to know whether it is possible to produce and sell edible fish until the appearance of snow and strong cold spells, as well as what size of young fish to stock in order to achieve that. In the case of larger quantities of fish produced, this is certainly more difficult to achieve due to the possibility of sale. The length of cultivation conditions the engagement of workers, which causes significant production costs.

The defined conditions and production technology for which the calculations were made are:

- water temperatures vary throughout the year (1 °C - 25 °C),
- breeding begins with the purchase of fingerlings with an average weight of 10 g and ends with the sale of table fish with an average weight of 250-350 g,
- the number of feeding days per year at water temperatures from 7 °C to 18 °C is 270-300.

The value of production is the value of table fish sold. The quantity of consuming Rainbow trout in both models M1 - Serbia and M2 - BiH is 50 t. The selling price

of Rainbow trout in Serbia varies during the year, with the wholesale price mostly depending on the current supply and price of Rainbow trout from imports (Turkey, Albania), as well as the price of surrounding markets (Serbia, BiH, Montenegro, Croatia). In the past 10 years, the wholesale price of trout in Serbia fco the buyer has varied between 2.8 €/kg and 3.3 €/kg (excluding VAT), with the current price being around 3.13 €/kg. In BiH, the average price is 2.97 €/kg. The planned productions, as well as the average realized ones, amount to 50 tons per year, which due to different sales prices between Serbia and BiH leads to a higher value of production in Serbia. In addition to the value of table fish, the total value of production includes incentives. In Serbia, the right to incentives is exercised for produced and invoiced fish in the amount of 10 RSD/kg, or 0.085 €/kg ("Official Gazette of RS", No. 61/2013 and No. 44/2014). In BiH, the amount of subsidies for freshwater fish varies depending on the entity, and in the case of the analyzed pond is 1.2 KM/kg, which is equivalent to 0.5114 €/kg (Official Gazette of the Federation of BiH, No. 14/2020). It is easy to see that the incentives per unit mass of table fish produced are more than 6 times higher in BiH than in Serbia.

Table 2. Analytical calculation of total production costs of Rainbow trout

ELEMENT OF CALCULATION		M1					M2				
No.	Value of production - VP	Quantity (kg)	Price (€/kg)	Value (€)	Cost (€/kg)	Share (%)	Quantity (kg)	Price (€/kg)	Value (€)	Cost (€/kg)	Share (%)
1	Table trout	50000	3.13	156500	-	-	50000	2.97	148500	-	-
2	Incentives	50000	0.09	4253	-	-	50000	0.511	25570	-	-
3	**Value of production - total**	-	-	160753	-	-	-	-	174070	-	-
	Variable costs - VC										
4	Fingerlings (10gr)	2500	10.00	25000	0.50	17.49	2150	7.70	16555	0.33	10.12
5	Food (FCR 1.25 SRB; 1.15 BiH)	59375	1.28	76000	1.52	53.17	55028	1.31	72086	1.44	44.06
6	Health treatment (examination + medicines)	-	-	1140	0.02	0.80	-	-	1278	0.03	0.78
7	Chemicals	-	-	400	0.01	0.28	-	-	512	0.01	0.31
8	Season workers	-	-	1200	0.02	0.84	-	-	-	-	0.00
9	Transportation of fish	50000	0.17	8500	0.17	5.95	50000	0.18	9204	0.18	5.63
10	Services	-	-	1100	0.02	0.77	-	-	6136	0.12	3.75
11	Risk	-	-	-	-	0.00	-	-	-	-	0.00
12	Other costs	-	-	-	-	0.00	-	-	7670	0.15	4.69
13	**Variable costs - Total**	**-**	**-**	**113340**	**2.27**	**79.29**	**-**	**-**	**113441**	**2.27**	**69.33**
	Fixed costs - FC										
12	Permanent labour force	-	-	22800	0.46	15.95	-	-	42949	0.86	26.25
13	Water fee	-	-	2125	0.04	1.49	-	-	1278	0.03	0.78

ELEMENT OF CALCULATION		M1					M2				
No.	Value of production - VP	Quantity (kg)	Price (€/kg)	Value (€)	Cost (€/ kg)	Share (%)	Quantity (kg)	Price (€/kg)	Value (€)	Cost (€/ kg)	Share (%)
14	Facility depreciation	-	-	4100	0.08	2.87	-	-	5218	0.10	3.19
15	Equipment depreciation	-	-	415	0.01	0.29	-	-	528	0.01	0.32
16	Property tax	-	-	164	0.00	0.11	-	-	209	0.00	0.13
17	**Fixed costs - Total**			**29604**	**0.59**	**20.71**	-	-	**50182**	**1.00**	**30.67**
18	**Total costs - TC**	-	-	**142944**	**2.86**	**100.00**	-	-	**163623**	**3.27**	**100.00**
19	**Financial result (no subsidies)**	-	-	**13556**	**0.27**	-	-	-	**-15123**	-	-
20	**Financial result - FR**	-	-	**17809**	-	-	-	-	**10447**	-	-
21	**Financial result after taxes - FRt**	-	-	**16028**	-	-	-	-	**10447**	-	-

Source: authors´ calculation,
Note: all prices without VAT, Parity: 1 EUR=1.9558 BAM, 1 EUR=117.5623 RSD

The price for fingerlings in the size of 10 g with transport is around 10 €/kg (excluding VAT) in Serbia, while in BiH it is significantly cheaper and costs 7.7 €/kg. Mortality losses during cultivation to consumption size according to the collected data are about 20% for model M1 (Serbia) and 7% for model M2 (BiH). This results in significantly higher costs for stocking fingerlings in Serbia (€ 25,000) compared to the fish farm in Bosnia (€ 16,559.1), in order to achieve the planned production of table fish of 50 t per year.

Feed Conversion Ratio (FCR) is the amount of feed consumed per kilogram of fish growth. At the analyzed farms, the FCR at the level of the entire production cycle ranges between 1.1 and 1.3 kg/kg. For the price in the calculation from table 2, the average price for medium energy feed (18-20 MJ/kg; digestable energy/kg feed) with transport, without VAT, was taken. The price of food in Serbia is lower, but due to the higher FCR as a consequence of poorer natural conditions for farming, the cost of feed at both observed farms is approximate. From an economic point of view, the most favorable feeding strategy does not have to be the one with the lowest FCR, nor the one with the cheapest feed (Vaško et al., 2011).

During the breeding of Rainbow trout, on average, each generation of fish is treated several times for bacterial (yersiniosis, furunculosis, flavobacteriosis) infections (Jeremić and Radosavljević, 2011; Radosavljević et al., 2013). The costs of medical treatment are calculated for the case of treatment of the entire fish biomass twice, at average weights of 15 and 50 g, which most often happens in practice at a fish farm in Serbia. According to the collected data, the costs of treatment at the observed cage trout farm in Bosnia and Herzegovina amount to 1,278.2 € / year.

Chemicals are used for the purpose of disinfecting farming cages, tools, equipment and accessories, but also for treating the fish. The most commonly used chemicals are hydrated lime, benzalkonium chloride, formalin, hydrogen peroxide, acetic acid (Burka et al., 1997), as well as chlorine and live lime for tank and dead fish sanitation.

Edible Rainbow trout is predominantly delivered freshly caught and chilled to 0-4 °C in appropriate packaging. Transportation costs consist of the costs of packaging, the packaging material, ice, driver's per diem and the cost of the means of transport. External transport can also be hired. The most common amounts of transport costs are between 0.1 €/kg and 0.25 €/kg in Serbia, while 0.17 €/kg was adopted for the calculation. In BiH, data were taken from the records of fish farm where the amount of these costs is € 9,204 per year, or 0.18 €/kg of produced table fish. Service costs include fees for an externally hired technologist, veterinarian, and an accountant.

Risk is the probability that for some unforeseen reason, production will experience complete or partial failure. Risk is calculated as part of the value of production (Bohl et al, 1999; Schaeperclaus und Lukovics, 1998) and classified as variable cost. In this paper, the risk is stated but not calculated, because such cases have not been known on the analyzed farms in the past.

The M1 (SRB) model envisages the permanent engagement of 5 workers, as well as the occasional engagement of additional labor on weekends and during harvesting, which corresponds to the real situation. In the M2 (BiH) model, labor costs were obtained from the survey collectively, without insight into the number of workers.

Water fee is a cost determined at the level of 1.5787 €/m^2 of cage area and 0.7289 €/m^2 of used shore according to the Decree on the amount of water fee for 2015 (Official Gazette of RS, 2015), which contributes to the cost of 0.043 €/kg of table fish. In BiH, the costs of using the water resource are calculated differently and they amount to 0.05 BAM/kg of fish sold, which is 1,278.25 € per year for a total of 50 t of table fish produced, or 0.026 € / kg.

Depreciation of facilities is the depreciation of production and ancillary facilities, such as a raft with breeding cages and a container for feedd and utensils. Equipment, such as kibla, fish cassettes, boat, mereds, grader, brushes, etc. are depreciated at significantly higher depreciation rates. Depreciation is calculated using the time-linear depreciation method based on the depreciation rates of the German Ministry of Finance (www.bundesfinanzministerium.de, 2020) for production facilities and used tools and equipment. Starting from the realistic assumption that the prices of materials and labor for making cages in RS and BiH are approximately the same, as well as that similar equipment is needed on ponds of the same capacity, it can be assumed that the corresponding depreciation will be approximately equal per unit capacity.

Property tax is prescribed at the level of 0.4% of the value of the immovable part of the company's property (Law on Property Tax, 2001, 2002, 2004, 2007, 2009, 2010) in the Republic of Serbia. Corporate income tax (Law on Corporate Income Tax, 2001, 2002, 2003, 2004, 2010, 2011, 2012, 2013, 2014) is calculated after the calculation of the financial result in case it is positive in the amount of 10% in the Republic of Serbia. Given that the surveyed cage farm from BiH in the Federation of BiH (legislation is different in the Republika Srpska and the Federation of BiH), profit tax is paid at a rate of 10% on the tax base determined in the tax balance (Law on Profit Tax, 2016).

Table 3. Relative indicators of economic efficiency

Indicator/Model	M1		M2	
	without incentives	with incentives	without incentives	with incentives
Economic efficiency of production (VP/TC) (€/€)	1.09	1.12	0.91	1.06
Production profitability (FR/VP) (%)	8.66	11.08	-10.18	6.00
Profitability of engaged capital (FR/TC) (%)	9.48	12.46	-9.24	6.38

Source: authors´ calculation

Observing the cost-effectiveness of production at € 1 of total costs incurred, the M1 model generates € 1.12 in revenue, while the M2 Model generates € 1.09 in revenue, taking into acount the case with incentives. The degree of profit in the total value of production is 11.08% (M1) and 6% (M2). Profitability of capital is 12.46% (M1) and 6.38% (M2), respectively, also looking at incentives.

Sensitivity analysis

The calculation of the total costs (*Table 2*) of the production of Rainbow trout in cage ponds shows that the financial result is positive in both models, if the current situation with subsidies is taken into account. In the case of the M2 model and assuming no subsidies, the financial result would be negative. For this reason, it is justified and advisable to examine the impact of the reduction in table fish prices, as well as the reduction in the amount of subsidies on the financial result of both models.

Table 4. Sensitivity of the financial result when changing the prices of table fish and incentives of the M1 model

Financial result		The price of table fish (€/kg)											
	X1 (%)	-25%	-20%	-15%	-10%	-5%	**Base**	+5%	+10%	+15%	+20%	+25%
Incentives (€/kg)	**X2 (%)**	€/kg	2.35	2.50	2.66	2.82	2.97	**3.13**	3.29	3.44	3.60	3.76	3.91
	-100	0.000	-25569	-17744	-9919	-2094	5731	13556	21381	29206	37031	44856	52681
	-80	0.017	-24719	-16894	-9069	-1244	6581	14406	22231	30056	37881	45706	53531
	-60	0.034	-23868	-16043	-8218	-393	7432	15257	23082	30907	38732	46557	54382
	-40	0.051	-23017	-15192	-7367	458	8283	16108	23933	31758	39583	47408	55233
	-20	0.068	-22167	-14342	-6517	1308	9133	16958	24783	32608	40433	48258	56083
	Base	**0.085**	-21316	-13491	-5666	2159	9984	**17809**	25634	33459	41284	49109	56934
	+20	0.102	-20466	-12641	-4816	3009	10834	18659	26484	34309	42134	49959	57784
	+40	0.119	-19615	-11790	-3965	3860	11685	19510	27335	35160	42985	50810	58635
	+60	0.136	-18764	-10939	-3114	4711	12536	20361	28186	36011	43836	51661	59486
	+80	0.153	-17914	-10089	-2264	5561	13386	21211	29036	36861	44686	52511	60336
	+100	0.170	-17063	-9238	-1413	6412	14237	22062	29887	37712	45537	53362	61187

Source: authors´ calculation

Based on official data (SORS, 2021), producer prices of Rainbow trout in the period from 2013 to 2020 ranged from 3.001 €/kg to 3.369 €/kg. Data on retail prices are available for BiH, which in the same period had values from 4.60 €/kg to 4.91 €/kg. The authors decided to examine the impact of changes in producer prices in the range from -25% to + 25% of the selling price of table fish in the sensitivity analysis.

Looking at incentives in aquaculture, the amounts vary depending on the entities in BiH. In the Republika Srpska, the amount of incentives is at the level of 0.35 BAM/kg of fish (0.179 €/kg), while in the Federation of BiH it varied between 1.16 BAM/kg to 1.25 BAM/kg (0.593-0.639 €/kg). In the Republic of Serbia, incentives for the production of table fish currently (year 2021) amount to 0.085 €/kg, while in 2013 they amounted to 0.062 €/kg. The variation of the amount of incentives was performed in the range from -100% to + 100% in relation to the currently valid ones. *Table 4* shows that at the moment, at the average price of sold fish for sale of 3.13 €/kg and incentives in the amount of 0.085 €/kg, the financial result of the M1 model is 17,809 €. It can also be seen that the production of Rainbow trout would achieve a positive financial result even without government incentives. The question of interest for the M1 model is: how much can the price of table fish decrease without the financial result being negative. This question can be answered if the value of production is equated with the total costs, ie. in case VP = TC. The marginal selling price (Gpc) corresponds precisely to the case when the value of production and total costs are equal, ie when their difference is equal to 0. Thus we get:

a) Gpc = 2.859 €/kg – for a case without incentives

b) Gpc = 2.774 €/kg – for a case with incentives

Table 5. Sensitivity of the financial result when changing the prices of table fish and incentives of the M2 model.

Financial result		The price of table fish (€/kg)											
		X1	-25%	-20%	-15%	-10%	-5%	Base	5%	10%	15%	20%	25%
Incentives (€/kg)	X2 (%)	€/kg	2.23	2.38	2.52	2.67	2.82	**2.97**	3.12	3.27	3.42	3.56	3.71
	-100	0.000	-52248	-44823	-37398	-29973	-22548	-15123	-7698	-273	7152	14577	22002
	-80	0.102	-47134	-39709	-32284	-24859	-17434	-10009	-2584	4841	12266	19691	27116
	-60	0.205	-42020	-34595	-27170	-19745	-12320	-4895	2530	9955	17380	24805	32230
	-40	0.307	-36906	-29481	-22056	-14631	-7206	219	7644	15069	22494	29919	37344
	-20	0.409	-31792	-24367	-16942	-9517	-2092	5333	12758	20183	27608	35033	42458
	Base	**0.511**	-26678	-19253	-11828	-4403	3022	**10447**	17872	25297	32722	40147	47572
	+20	0.614	-21564	-14139	-6714	711	8136	15561	22986	30411	37836	45261	52686
	+40	0.716	-16450	-9025	-1600	5825	13250	20675	28100	35525	42950	50375	57800
	+60	0.818	-11336	-3911	3514	10939	18364	25789	33214	40639	48064	55489	62914
	+80	0.921	-6222	1203	8628	16053	23478	30903	38328	45753	53178	60603	68028
	+100	1.023	-1108	6317	13742	21167	28592	36017	43442	50867	58292	65717	73142

Source: authors´ calculation

The selling price of Rainbow trout can fall by 8.66% in the absence of incentives, as well as by 11.38% in the case of incentives without the financial result becoming negative.

Model M2 shows a negative financial result without incentives. With the currently valid incentives, the selling price of table fish can be reduced to 2.76 €/kg or by 7.04% while keeping the financial result positive. Otherwise, at the current average price of 2.97 €/kg of table fish, incentives can be reduced to 0.21 €/kg or by 40.9% while keeping the financial result positive.

Conclusions

Based on the compiled analytical calculations of total production costs of Rainbow trout in the Republic of Serbia (M1) and Bosnia and Herzegovina (M2), it was shown that the financial result is positive in the M1 model and amounts to 13,555.8 € without incentives and 17,809 € with incentives of 0.085 €/kg fish. In the M2 model, the financial result is negative (-15,123 €) without incentives, but is positive with incentives of 0.511 €/kg and amounts to 10,447 €.

The variable costs of both models are very approximate, although they differ significantly in their structure. In the cost structure, variable costs participate with 79.3% in total costs (M1) and 69.3% (M2).

Fixed costs are € 29,604.2 (20.7%) in the M1 model and € 50,182.1 (30.7%) in the M2 model. Such a large difference primarily stems from the much higher costs of permanently employed workers at the fish farm in BiH (€ 42,949) compared to the same in Serbia (€ 22,800). Other fixed costs are proportional in both models and also do not significantly affect the achieved financial result.

The cost price of consuming Rainbow trout is 2.69 €/kg without transportation costs at the fish farm in Serbia, or 3.09 €/kg in BiH. With transportation costs, the cost price is 2.86 €/kg for the M1 model and 3.27 €/kg for the M2. Variable costs in both models participate in the cost price structure of 2.27 €/kg.

Variable costs have a smaller share in the total costs in the case of concrete (raceway) ponds (Čanak et al., 2015), primarily due to the higher amount of depreciation costs. The cost structure also differs depending on the different conditions of production and business in countries around the world (Hasaan et al., 2007).

The costs of permanently hired workers represent the greatest burden and the cause of the negative economic result of the M2 model. In other words, 0.48 € (0.46 €/kg + 0.02 €/kg) is spent on permanently and occasionally hired workers in the M1 model for the production of 1 kg of consuming Rainbow trout, while on the M2 model 0.86 €/kg is needed. Such high labor costs indicate very low labor productivity and most likely too many employees. A possible solution is to reduce the number of full-time employees, and to hire additional labor as needed.

Improving the economic result is possible by increasing the value of production, which is possible if part of the table fish is sold at retail prices. This represents a realistic possibility that small producers do apply in practice, selling table fish on the local market.

Sensitivity analysis showed that with each change of 1% in the selling price of table fish in M1 model there is a change in the financial result of 1,565 €, while with a change of 1% in incentives, there is a change in the financial result of 42.5 €. In the M2 model, a change in the selling price of 1% leads to a change in the financial result of € 1,485, while a change in the incentives of 1% leads to a change in the financial result of € 511.4.

Subsequent analysis showed that in the M1 model, the selling price of table fish can decrease to 2,859 €/kg (case without incentives), or to 2,774 €/kg (with incentives), so that the financial result remains positive. In the M2 model, incentives can be reduced by 40.9%, while the financial result would remain positive.

Relative indicators of economic efficiency of Rainbow trout production in cage farms show significantly better results in the case of model M1 than for model M2, as well as absolute indicators.

The main reason for the negative financial effects of the M2 model without incentives are the very high fixed costs of permanent employees. The authors believe that a more detailed analysis of the real needs for such a large engagement of labor on the fish farm in BiH should be done.

Conflict of interests

The authors declare no conflict of interest

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THE RESIDENTS' ATTITUDES ABOUT THE DEVELOPMENT OF HUNTING TOURISM IN VOJVODINA (SERBIA)

Milosava Matejević[1], Tamara Jovanović[2], Igor Ponjiger[3], Zoran Ristić[4], Vladimir Marković[5], Milutin Kovačević[6]

**Corresponding author E-mail: igor.ponjiger@dgt.uns.ac.rs*

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ABSTRACT

Successful development of hunting tourism requires the support of a local community and positive attitudes of residents. This research aims to explore the population in the Vojvodina region (Serbia) which was well known hunting tourism destination in Europe during the '70s and '80s. The survey included a final sample of 206 respondents. This study showed that residents mostly approve of and support hunting tourism revitalization. However, they find that it needs to be implemented sustainably, according to the law, without threatening the habitat and game funds. This study also explored different predictors that shape attitudes towards hunting tourism. Results show that being a hunter, having a higher level of education, frequently having outdoor activities in nature, being interested in the topic of hunting and hunting tourism, and having a dominant meat diet lead to a more positive attitude towards hunting tourism.

1 Milosava Matejević, associate professor, DGTH, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, Phone: +381214852845, E-mail: milosava@dgt.uns.ac.rs, ORCID ID (https://orcid.org/0000-0001-5345-774X)

2 Tamara Jovanović, associate professor, DGTH, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, Phone: +381214852845, E-mail: milosava@dgt.uns.ac.rs, ORCID ID (https://orcid.org/0000-0002-2899-9544)

3 Igor Ponjiger, teaching assistant, DGTH, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, Phone: +381214852845, E-mail: igor.ponjiger@dgt.uns.ac.rs, ORCID ID (https://orcid.org/0000-0001-9426-5250)

4 Zoran Ristić, full professor, DGTH, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, Phone: +381214852845, E-mail: zoran.ristic@dgt.uns.ac.rs, ORCID ID (https://orcid.org/0000-0001-7273-1177)

5 Vladimir Marković, full professor, DGTH, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, Phone: +381214852845, E-mail: vladimir.marković@dgt.uns.ac.rs, ORCID ID (https://orcid.org/0000-0002-6545-5263)

6 Milutin Kovačević, assistant professor, DGTH, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, Phone: +381214852845, E-mail: milutin.kovacevic@dgt.uns.ac.rs, ORCID ID (https://orcid.org/0000-0002-7260-6066)

Introduction

Hunting tourism is often defined as a type of consumptive activity within the broader definition of wildlife tourism. It represents the trip and other activities conducted by tourists whose main motive for that trip is hunting. Hunting and hunting management is an important part of cultural heritage and can be seen as a form of sustainable wildlife use. Hunting tourism, similar to other forms of tourism, should be developed following the principles of ecological, economic, and social sustainability in tourism. From an ecological point of view, well-planned and organized hunting and hunting tourism can be sustainable and beneficial for nature protection. However, hunting tourism can be a form of sustainable use of wildlife resources only if it is based on scientific assessments of population numbers with defined hunting quotas. Also, it needs to be competently regulated and incorruptible – without poaching. Studies also show that hunting tourists are less destructive to the natural environment than other types of tourists, as they use fewer services and infrastructure (Baker, 1997; Di Minin et al., 2016).

During the second half of the last century, Serbia was considered a notable hunting tourism destination in this region (Ristić et al., 2009), and hunting tourism activities were mostly taking place in Vojvodina, the northern province of Serbia. The favorable geographical position, rich wildlife funds and diversity of wildlife, hunting tradition, and hospitality contributed to the massive development of hunting tourism in Vojvodina with an average of 3-4 thousand foreign hunters per year, mostly coming from Western and Central Europe and Russia (Dragin, 2006; Marković et al., 2017). After the deterioration of the political stability in the country, in the mid-1990s, the number of hunting tourists dropped drastically (Dragin, 2006). Even though there are no official data on the numbers and revenues from annual hunting tourism in the Vojvodina region, foreign hunters are starting to return and the number of organized hunts is steadily increasing.

All of the above indicates that hunting tourism was historically significant to the economy of the Vojvodina Region and could make a significant economic impact on the community in the future. Therefore, this paper aims to explore the attitudes of the local community (hunters and non-hunters) towards the revitalization of hunting tourism in Vojvodina. Hunting and hunting tourism is generally considered to be a controversial topic and activity throughout the world. Consequently, the goal is to explore the population in the Vojvodina region which had significant economic benefits from this type of tourist activity during the end of the last century. Considering all this, the main research question is whether the local community supports this type of tourism and its revitalization.

Literature review

As a selective form of tourism, hunting tourism can be seen as an additional opportunity for the development of marginal rural areas where there are no other types of tourism present (Baker, 1997; Gunnardotter, 2006; Lindsey et al., 2006; Ruralia Institute, 2007; Samuelsson et al., 2007; Willebrand, 2009). Many authors point out the positive effects

that hunting and hunting tourism have on the local community (Bauer & Herr, 2004; Chardonnet et al., 2002; Mbaiwa & Stronza, 2010; Naidoo et al., 2016; Samuelsson et al., 2007; Sharp & Wollscheid, 2009). Also, both provide significant economic benefits (Barnes, 2001; Bauer & Herr, 2004; Hull et al., 2007). Chardonnet and colleagues (2002) point out that the socio-economic impact of hunting on the local community since the end of the 20th century in the EU is significant.

Hunting tourism arrangements are considered to be much more costly compared to the other types of tourism, and a large part of the income remains for the local community (Baker, 1997; Di Minin et al., 2016). Pinet (1995) pointed out that in the EU, the hunting-related industry generated a financial turnover of 9.88 billion euros and around 100,000 jobs. In the United States and Canada, proceeds from hunting licenses generate hundreds of millions of dollars annually that are further used for management and habitat protection (Leader-Williams et al., 1996; Naidoo et al., 2016).

Socially sustainable tourism development implies cultural sustainability, equal distribution of benefits and burdens between stakeholders, and the opportunity to participate in decisions affecting all groups (Nygard & Uthardt, 2011; Puhakka et al., 2009; Rannikko, 1999). For the development of tourism, it is of great importance to be supported by the local community (Gursoy & Rutherford, 2004). Study in Spain has shown that residents' support of tourism development will be higher if they have benefits from it (Oviedo-Garcia et al., 2008).

Willebrand (2009) points out that the development of hunting tourism today is mostly affected by the residents' ethical values on using wildlife for consumption of wildlife, but also by the attitudes of local hunters towards hunting tourists. Some studies have shown that local hunters have a positive attitude towards the development of hunting tourism as possible means of revitalizing rural areas (Ruralia Institute, 2010; Rutanen et al., 2007). However, local hunters also have certain fears because they believe that it would bring them increased hunting fees, and limit the possibility of hunting activities in favor of hunting tourists (Ruralia Institute, 2007; Nygard & Uthardt, 2011; Watts & Hunter, 2010; Willebrand, 2009). It is very important to understand the attitudes of hunters, as a key element of the social sustainability of hunting tourism development (MacKay & Campbell, 2004), considering they "constitute a central stakeholder group" (Nygard & Uthardt, 2011). Coetzer & Van Niekerk (2012) point out that negative attitudes toward hunting and hunting tourism are often due to misconceptions.

Nygard & Uthardt (2011) have shown that attitudes towards the development of hunting tourism depend on hunting experience, hunting preferences, wildlife management activities, socio-economic position, and one's activity as a hunter and/or wildlife manager. The attitudes of the local community on recreational and tourist hunting are significantly influenced by the respondents' age and place of residence however gender is not a significant predictor of attitudes (Ljung et al., 2012). However, Byrd and colleagues (2017), in their North American study, state that women are less supportive than men of hunting. Also, they point out that women view animals differently from

men since women are concerned more with animal welfare. Gamborg & Jensen (2017) have shown that there is no significant effect of gender. In addition, the age of the respondents has been singled out in many studies as a factor of great influence on hunting attitudes (Peterson et al., 2009). Younger respondents tend to have a more negative attitude towards hunting (Byrd et al., 2017; Gamborg & Jensen, 2017; Ljung et al., 2012). Heberlein & Ericsson (2005) indicate that rural residents in Sweden were more positive toward hunting and wildlife than urban residents, but also, found that urban residents with the highest level of contact with rural areas shared the same attitudes as rural residents. Similar results have also been found in surveys carried out in Denmark which have shown that living in urban communities has increased negative attitudes towards hunting (Gamborg & Jensen, 2017). Peterson and colleagues (2009) found differences in attitudes between students that are hunters and non-hunters where hunters had a more positive and supportive attitude. Interestingly, among the inhabitants of Sweden, non-hunters mostly expressed positive attitudes towards hunting and hunters, and support for hunting increased from 72% in 1980 to 84% in 2012 (Ljung et al., 2012). A positive attitude towards hunting and hunting tourism is more present among people who have a hunter as a friend or a family member (Byrd et al., 2017; Gamborg & Jensen, 2017; Ljung et al., 2012; Stedman & Heberlein, 2009). Dietary habits can also lead to different attitudes towards hunting and hunting tourism. Research by Ljung and colleagues (2012) showed that the frequency of game-meat consumption affects positively attitudes toward hunting. As for the effect of education, those with lower educational levels are more supportive of hunting and hunting tourism (MacKay & Campbell, 2004; Teel et al., 2002). Similarly, Donnelly and Vaske (1995) showed that those with less education and income have a higher level of support for hunting activities. Even though there is no previous research on the effect of the frequency of outdoor recreation on attitudes towards hunting tourism, there are studies that show that those with fewer contacts with nature have a more negative attitude towards hunting activities (Heberlein & Ericsson, 2005). People who spend time in nature are more likely to see the effects of hunting management and therefore have a more positive attitude. Finally, Stedman and Decker (1996) state that interested parties and those that have greater familiarity with the hunting itself would have a more positive outlook on hunting activities.

Even though most of the previous studies explore attitudes towards hunting, we believe that their findings can be applied to the context of hunting tourism as well, since the base of hunting tourism is hunting itself. Therefore, the following hypotheses were formulated:

H1: Hunters will have a more positive attitude towards hunting tourism and its development in their local community than non-hunters.

H2: Having a personal relationship with a hunter (as stated in descending order by the categories "hunter as a member of the family", "hunter as a close friend", "hunter as an acquaintance", "hunter as a person that you know of") will result in a more positive attitude towards hunting tourism.

H3: Older respondents will have a more positive attitude towards hunting tourism and its development than younger.

H4: Male respondents will have a more positive attitude towards hunting tourism than females.

H5: Respondents with lower levels of education will result in a more positive attitude toward hunting tourism than those with higher levels of education.

H6: Respondents with lower incomes will have a more positive attitude towards hunting tourism.

H7a: Respondents who grew up in rural areas will have a more positive attitude towards hunting tourism than those who grew up in urban areas.

H7b: Respondents who currently live in rural areas will have a more positive attitude towards hunting tourism than those who currently live in urban areas.

H8: Respondents who spend more time doing outdoor activities in nature will have a more positive attitude towards hunting tourism.

H9a: Respondents who believe they are familiar with the topic of hunting and hunting tourism will have a more positive attitude towards hunting tourism.

H9b: Respondents who state that they are interested in the topic of hunting and hunting tourism will have a more positive attitude towards hunting tourism.

H10: Respondents with less meat consumption will have a more negative attitude towards hunting tourism.

Methodology

Study sample

The final study sample consists of 206 respondents residing in the Autonomous Province of Vojvodina, Serbia. There are slightly more female (64.1%) than male (35.9%) respondents in the sample, while the average age of the sample is 26.08 (18-60 years, Std=7.551). The majority of respondents have a secondary school degree (48.5%), following a high number of master's degree holders (23.3%). The income of the respondents is cited as lower than average (61.7%). When asked about childhood residence, most of the respondents cited a village (36.4%) and a small city (34.5%). In terms of their current residence, respondents mostly answered that they live in a big city (54.4%). The main socio-demographic characteristics and hunting-related topics of respondents can be seen in Table 1.

Table 1. Socio-demographic characteristics and hunting-related topics of respondents in % (N=206)

Gender:		**Hunter:**	
Male	35.9	Yes	17.0
Female	64.1	No	83.0
Education:		**Association with hunters:**	
Secondary school	48.5	Family member	25.2
Higher school/Bachelor	28.2	Close friend	23.8
Master's degree	23.3	Acquaintance	25.7
Income:		Don't know them personally but I have heard of them	15.5
Lower than average	61.7	No	9.7
Somewhat average	27.2	**Outdoor activities in nature:**	
Higher than average	11.2	Once a month or often	59.7
Childhood residence:		4-6 times a year	24.8
Village	36.4	1-3 times a year	15.5
Suburb	10.7	**Familiar with hunting and hunting tourism-related subjects:**	
Small city	34.5	Strongly disagree	16.5
Big city	18.4	Somewhat disagree	14.1
Current residence:		Somewhat agree	46.1
Village	15.0	Strongly agree	23.3
Suburb	11.2	**Interested in hunting and hunting tourism-related subjects:**	
Small city	19.4	Strongly disagree	29.1
Big city	54.4	Somewhat disagree	15.5
Hunting tourism is:		Somewhat agree	30.6
Sale of valuable hunting trophies	15.5	Strongly agree	24.8
Travel for the sake of hunting	43.2	**Diet:**	
Outdoor recreation	21.8	Mostly meat	23.3
Wildlife photography	3.9	Balanced meat/vegetable	73.3
Wildlife watching	11.7	Vegetarian	3.4
Other	3.9		

Source: Author's calculations

It is also important to mention that most of the respondents are non-hunters (83%). Personal association with hunters was mostly evenly balanced with a similar number of respondents citing having a hunter within the family (25.2%), as a close friend (23.8%), or as an acquaintance (25.7%). Respondents somewhat agree (46.1%) or strongly agree (23.3%) to be familiar with hunting and hunting tourism-related subjects. Concerning the claim that hunting and hunting tourism is interesting to them, most of the respondents somewhat agree (30.6%) and strongly disagree (29.1%). Most of the examined sample cited having outdoor activities once a month or more (59.7%). The majority of the sample claims to have a balanced diet – meat, and vegetables equally (73.3%).

Instruments

The questionnaire consisted of two parts. The first part included socio-demographic characteristics of respondents (gender, age, education, income, place of childhood and

place of current residence, frequency of outdoor activities in nature, dietary habits) and hunting and hunting tourism-related variables (participation in hunting activities, relationship with hunters, prior knowledge and interest in hunting, definition of hunting tourism). The second part consisted of a series of statements where respondents were asked to state their opinions and attitudes about hunting tourism. Statements ranged from different types of opinions about the development of hunting tourism, economic benefits, ecological impact, etc. In this part of the questionnaire, respondents were asked to express their level of agreement/disagreement on a 4-point Likert scale (1 – I totally disagree, 2 – I somewhat disagree, 3 – I somewhat agree, 4 – I totally agree) with the offered statements. This scale of attitudes was made by authors and was inspired by the research of Byrd and colleagues (2017) and Gamborg & Søndergaard Jensen (2017). Also, some of the statements represent previously experienced opinions and misconceptions that the authors have encountered.

Procedure

The survey was conducted from the second half of December 2018 till the first half of January 2019. The sample was gathered by trained students of the University of Novi Sad as part of the course requirement. The respondents were informed that the survey is anonymous and that their participation is voluntary.

Results

Before statistical analyses, data cleaning was conducted. The initial sample size was 223 respondents. The original sample was reduced to 10 respondents that responded with the same answer for all statements about hunting tourism attitudes. Seven other respondents were excluded from the sample due to their atypical responses. This resulted in the final sample of 206 respondents.

Exploratory factor analysis (EFA) was conducted using SPSS 17.0. The principal component exploratory factor analysis was performed. Representativeness was good (*KMO* = .932) and Bartlett's sphericity test was significant ($\chi^2(136) = 2325.99$, $p <$ .000), which confirmed that the data is suitable for the analysis. Statement number 8 was excluded due to the low communality. Scree plot and Eigenvalue suggested that a one-factor solution would best fit the data. Therefore, the unidimensional structure was extracted with 50.61 % of variance explained (see Table 2). Varimax rotation was applied. Seven items (1, 5, 9, 10, 11, 13, 15) were recoded since their factor loadings were negative. The reliability of the scale is high with the value of Cronbach's alpha .936. Mean values are represented in Table 2 in a non-recoded form to show the respondents' level of agreement with all attitudes.

Table 2. Component matrix of the proposed model (N=206)

Statements	Factor Loadings	Mean (unreversed values, M=2.5)	Std. Deviation
I wouldn't oppose hunting tourism development in my area. (S16)	.902	2.69	1.156
I approve of hunting tourism as one of the contributors to the local community development. (S17)	.890	2.76	1.113
Hunting tourism is an industry that should be invested in. (S3)	.884	2.70	1.085
Hunting tourism is contributing to the promotion of Serbia as a tourist destination. (S4)	.810	2.91	1.025
If hunting tourism would provide new job opportunities and economic progress in my area, I would have a more positive attitude toward hunting and hunting tourism. (S18)	.768	2.83	1.084
Hunting tourism leads to plant and animal destruction. (S1r)	.766	2.0485	.98653
Revenue generated through hunting tourism is being used to protect hunting grounds and wildlife. (S7)	.759	2.59	.932
Hunting tourism development leads to the economic prosperity of the local community. (S14)	.736	2.77	.922
I believe that hunting trophy exhibitions are an inappropriate way of treating wild animals. (S10r)	.704	2.4320	1.16566
Hunting tourism helps the economic development of rural areas, otherwise not suitable for other use. (S12)	.699	2.92	.957
Hunting tourists often have a disrespectful attitude toward nature and the local community. (S5r)	.662	2.2476	.96871
Hunting tourism influences the increase of employment in the local community. (S2)	.611	2.67	.967
Hunting tourism is linked to smuggling wild animals. (S11r)	.589	2.3689	1.03113
An increase in the number of hunting tourists leads to a significant decrease in funds of game in hunting grounds. (S9r)	.580	2.4078	.97217
Hunting tourism generates bigger revenue compared to traditional types of tourism. (S6)	.543	2.51	1.011
Hunting tourism development increases the level of corruption. (S13r)	.506	2.1942	.93243
Hunting tourists are allowed to hunt over the planned cull to gain greater profit. (S15r)	.486	2.2476	1.03210
Extraction Method: Principal Component Analysis. (a. 1 component extracted.) *r beside item designation stands for recoded*			

Source: Author's calculations

Results of the path model

To test the hypotheses, path model analysis was conducted in EQS 6.1 software. Given that the value of multivariate kurtosis was over 7, the robust method was used (Bentler, 2006). Following fit indices were used: Sattora–Bentler χ^2 (S-Bχ^2), which should not be statistically significant, and ratio $\chi 2/df$, which should be less than 2 (Hoelter, 1983), or

less than 3 (Kline, 2015); the square root of the mean squared errors of approximation (RMSEA) and the standardized square root of the average of the square residuals (SRMR) which should be less than .08; Bentler Comparative Fit Index (CFI) and Tucker Lewis Index (TLI), which should be higher than .90 for adequate model fit (Hu &Bentler, 1999).

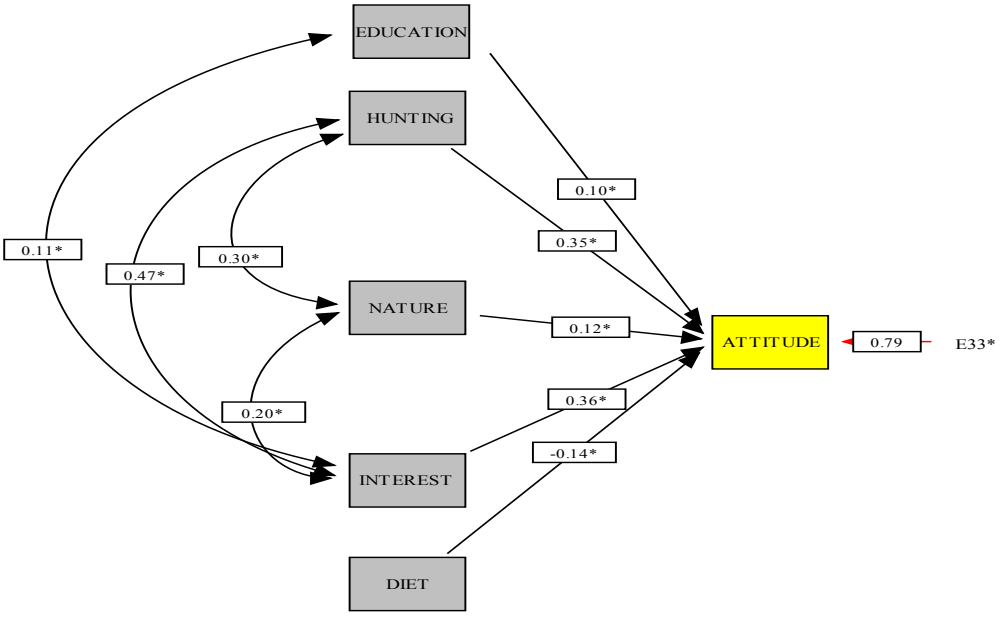
Table 3. Model fit indices of the proposed model (N = 206)

Model	*S–Bχ²*	*f*	*²/df*	RMSEA (90% CI)	SRMR	CFI	TLI
1	406.21	66	6.15	.158 (.143 – .173)	.178	.242	.311
2	15.90	7	2.27	.077 (.023 – .129)	.070	.953	.873
3	12.72	6	2.12	.073 (.000 –.130)	.063	.964	.909

Note: Values of *S-Bχ²* in Model 3 are not significant at *p*>.01.

All predictors were included in the first model which showed unsatisfactory fit indices (see Model 1, Table 3). Wald test suggested exclusion of gender, age, monthly income, place of current and place of childhood residence, relationship with a hunter, and familiarity with hunting and hunting tourism. Also, the LM index suggested including correlations between remaining socio-demographic variables: 1. hunter (yes/no) and frequency of outdoor activities in nature, 2. hunter and interest in hunting and hunting tourism, 3. frequency of outdoor activities in nature and interest in hunting and hunting tourism. This resulted in a much better fit (see Model 2, Table 3). The final model suggested a correlation between the level of education and interest in hunting and hunting tourism (see Figure 1 and Model 3, Table 3).

Figure 1. Standardized factor loadings for the proposed model (b/w print)



Legend: EDUCATION – level of respondents' education, HUNTING – is respondent a hunter or not, NATURE – frequency of outdoor activities, INTEREST – respondent having an interest in the hunting and hunting tourism topic, DIET – the respondents' type of diet

Discussion

To examine the attitudes of residents, the authors created an 18 items attitudes scale inspired by the authors' previous experiences and the research of Byrd and colleagues (2017) and Gamborg & Jensen (2017). The scale shows good metric characteristics, with a reliability above .90 and a unidimensional structure. Results show generally favorable attitudes towards hunting tourism and its revitalization in the Vojvodina region. Residents believe that hunting tourism could contribute to the promotion of Serbia as a tourist destination. They seem ready to offer support to the revitalization of hunting tourism in Vojvodina especially if that would lead to new job opportunities and economic prosperity. Most of the respondents wouldn't oppose hunting tourism development in their area and believe it should be invested in since revenue generated through hunting tourism could be used to protect hunting grounds and wildlife.

Earlier published results showed that communities have a more positive attitude towards the development of hunting as it is seen as a possible means for revitalizing rural areas (Campbell & Mackay, 2003; Matilainen & Keskinarkaus, 2010; Rutanen et al., 2007), but that sometimes residents don't approve hunting as a sport and recreational activity (Campbell & Mackay, 2003). In this study, there are also certain fears and uncertainties concerning the revitalization of hunting tourism. A third of respondents believe that hunting tourism leads to plant and animal destruction and that hunting tourism development increases the level of corruption. Almost half agree that it leads to a significant decrease in funds of game in hunting grounds and that hunting tourism is connected to smuggling wild animals. The statement that caused the most variations in answers was the one concerning hunting trophy exhibitions seen as an inappropriate way of treating wild animals. Respondents generally believe that trophy exhibitions are ethically disrespectful. However, 52% of respondents are probably accustomed to it since they approve it. This might bedue to the fact that it is deeply rooted in hunting tradition.

Besides examining the attitudes toward hunting tourism and its revitalization, the authors also aimed to explore different predictors that could shape these attitudes. Those predictors are either respondents' characteristics (gender, age, education, income, place of childhood and place of current residence, frequency of outdoor activities in nature, dietary habits) or hunting and hunting tourism-related variables (participation in hunting activities, relationship with hunters, prior knowledge and interest in hunting, definition of hunting tourism). According to the path analysis, variables that significantly shape attitudes about hunting tourism in the Vojvodina region are *being a hunter* (H1), *education* (H5), *the frequency of outdoor activities in nature* (H8), *interest in the topic of hunting and hunting tourism* (H9b) and *dietary habits* (H10). One of the starting hypotheses, based on previous research, was that hunters have a more positive attitude towards hunting tourism and its development in their local community than non-hunters (Peterson et al., 2009). Results of this study substantiate it. Also, respondents that are more often actively spending time in nature have a more positive attitude towards hunting tourism which is following our initial assumption. Respondents with less meat consumption will have a more negative attitude which confirms our hypothesis. Finally,

we assumed interest in the topic of hunting and hunting tourism leads to a more positive attitude. Despite our expectations, a higher level of education leads to a more positive attitude towards hunting tourism and its revitalization. However, previous research indicates that negative attitudes toward hunting and hunting tourism are often based on a misconception of these activities (Coetzer & van Niekerk, 2012), which could explain this result. Higher educated respondents might be more aware of the possible positive effects of developing hunting tourism in their local community.

Previous research indicates that gender, age, place of childhood/current residence, income, personal relationship with a hunter, and familiarity with the topic affect attitudes towards hunting and hunting tourism (Byrd et al., 2017; Gamborg & Jensen, 2017; Heberlein & Ericsson, 2005; Ljung et al., 2012; Peterson et al., 2009; Stedman & Decker, 1996). In our study, these predictors did not show a significant influence on attitudes. Despite our initial assumptions, results about gender and income coincide with the studies of Gamborg and Jensen (2017) and Ljung and colleagues (2012) while the place of childhood/current residence results coincides with the study of Heberlein and Ericsson (2005). The effects of these sample characteristics vary in different studies which might be due to cultural specificities and future research should explore this further. Even though previous research shows that having a personal relationship with a hunter will result in a more positive attitude towards hunting tourism (Byrd et al., 2017; Gamborg & Jensen, 2017; Ljung et al., 2012; Stedman & Heberlein, 2009), it did not significantly predict positive attitudes in this research (H2). This could be explained by the fact that there were only 9.7% of the respondents did not have any personal relationship with a hunter while most had close personal interactions (74.8%). There was also a small variance of responses for the variable familiarity with the topic of hunting and hunting tourism since 70% of respondents claim to be familiar with this topic. Finally, our respondents were mostly young people which might be the reason why there was no effect of age on attitudes towards hunting tourism and its revitalization. While the idea was to have a more diverse age-group sample most of our respondents ended up being younger. However, this is not a limitation to the study since we find them to be an important stakeholder group that possibly could have an important role in the future development of hunting tourism. Also, they stand to have the most benefits in hunting tourism development. Since their attitudes were mostly positive, we assume that they are aware of all this.

Conclusion

The goal of this paper was to determine the attitudes of the local population towards hunting tourism and its revitalization in Vojvodina (Serbia). This region is historically a renowned hunting tourism destination and was intensely developed in the second half of the 20th century with economic benefits for the local community. Therefore, one of the main reasons to conduct research in this region was to examine the current attitudes of residents towards this form of tourism. Public opinion over topics of hunting and hunting tourism tends to become more unfavorable. This is one of the main reasons

why potentially attractive hunting tourism destinations need to have sufficient support from the local community for the development of this type of tourism.

As with every study, there are certain limitations. Our sampling procedure was convenient and a more diverse sample would be preferable. Future research could potentially include neighboring countries with developed hunting tourism. Also, data concerning the number of hunting tourists and revenue generated by hunting tourism in Vojvodina is very scarce. Even though this is a limitation, it leads to the conclusion that hunting tourism is currently poorly organized and underdeveloped in the Vojvodina region which makes the findings of this research valuable. Knowing that people are open to the idea of hunting tourism revitalization in their surroundings can help and motivate all the stakeholders to take action in this field.

This study showed that residents in Vojvodina mostly approve and support hunting tourism revitalization and find that it needs to be implemented sustainably, according to the law, without threatening the habitat and game funds. Hunting tourism managers and hunting tourism employees should intensify the promotion of hunting tourism and, above all, educate the general population about the benefits of proper hunting management and hunting tourism. This study also explored different predictors that shape attitudes towards hunting tourism. Socio-demographic characteristics strongly affected the attitudes. This shows the significance of the upbringing and cultural values of the region in forming the attitudes towards hunting. Results show that being a hunter, having a higher level of education, frequently having outdoor activities in nature, being interested in the topic of hunting and hunting tourism, and having a dominant meat diet lead to a more positive attitude towards hunting tourism.

Conflict of interests

The authors declare no conflict of interest.

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INTERDEPENDENCE OF INTERESTS OF SELLERS AND CONSUMERS BY SELLING AGRICULTURAL PRODUCTS ON MARKETPLACES

Boris Kuzman[1], Nedeljko Prdić[2], Sara Kostić[3]

**Corresponding author E-mail: nedeljko.prdicns@gmail.com*

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ABSTRACT

Marketplace sales in trade dates back to the Middle Ages. The meaningfulness and development of communication gained real meaning with the development of the marketplaces. Today, personal selling is part of the distribution of agricultural products and part of modern marketing. With the development of the global market and modern information technologies, the role of marketplace sales has taken on another dimension. The aim of this paper is to define the model of efficient sales on the market through direct marketing, sales promotion and living words. The results of theoretical research are based on scientific and professional literature, statistical data and tables, authors' experience, whereas field empirical research was conducted using a questionnaire. The results of empirical research show that the average desire for changes in the behaviour of sellers in sales and consumers in shopping is not present enough. From the conducted research, it can be concluded that in certain previously mentioned aspects of changes in behaviour, marketing communication can be established that will contribute to increasing consumer satisfaction and information.

Introduction

Marketplace sales are the oldest form of human activity. The latest trends in the last ten years in developed countries point to the fact that green markets have regained their old

1 Boris Kuzman, PhD, Associate Professor, Institute of Agricultural Economics, 15 Volgina Street, SRB-11060 Belgrade, Serbia, Phone: +381 63 590 129, E-mail: kuzmanboris@yahoo.com, ORCID ID (https://orcid.org/0000-0002-8661-2993)

2 NedeljkoPrdić, PhD, Assistant Professor., JKP Tržnica, 4 Žike Popovića, SRB-21000 Novi Sad, Serbia, Phone:+381 63 500 818, E-mail: nedeljko.prdicns@gmail.com, ORCID ID (https://orcid.org/0000-0003-3199-1188)

3 Sara Kostić, PHD student, University of Novi Sad, Faculty of Economics, 9-11 Segedinski put broj, SRB-24000 Subotica, Serbia, Phone: +381 63 572 260, E-mail: sara97kostic@gmail.com, ORCID ID (https://orcid.org/0000-0002-5079-1096)

reputation by selling fresh products that are much higher quality than in other shopping centres. Agricultural production is one of the key activities of the economy of the Republic of Serbia, given the availability of natural and human resources (Užar et al., 2019). Marketplaces are one of the oldest market institutions in the trade of agricultural products and one of the primary indicators of the development of the agricultural complex (Kuzman et al., 2020). In developed countries, the trend of developing green markets is based on the extension of working hours, accompanied by additional services to consumers. The sale of fruits and vegetables on the marketplace is still mostly related to smaller producers, as well as to producers of organic products. Its activities in the promotion should emphasise a certain seasonal extra value of the product, a better offer, quality and freshness compared to the competition. (Prdić et al., 2021). Marketplaces in the future cannot be a serious competition to retail chains, except for a large concentration of supply, but they can be places to sell fresh products and products of organic origin. In the past period, the biggest changes in the marketplace activity occurred as a consequence of the establishment of new, organised forms of supplying the population with various items, including fresh food. (Ostojić et al., 2013). Personal and intensive, interactive communications in the form of direct marketing, personal sales and sales promotion as well as living words make a long-term step forward in marketplace sales.

Marketplace vendours use sales and communication techniques to guide the customer to buy their product. The fact is that in the era of competition, sellers on the marketplace realise that the relationship with consumers is very important, that the integration of personal sales instruments has a long-term significance for successful sales. Creativity and intelligence of the seller are the basic prerequisites for efficient sales. Product sales as a marketing tool, integrated with the word-of-mouth in terms of on-site sales, is an approach in which the seller and buyer directly determine the common interest, based on appropriate quality and low prices and good communication that results in consumer satisfaction as end user (Prdić et al., 2019). The essence of a good value delivery system is a set of key business processes that help deliver special value to the customer (Mittal et al., 2005).

The point of sale and the word-of-mouth is the last attempt of the seller to successfully communicate with the consumer. The art of trading is an old method of trade that can be safely applied in the marketplaces. Creativity in communication derives from the goal of sales and is focused on communication with the consumer in order to persuade them to buy products. A skilled salesman should show understanding for the customer who visited the marketplace and his point of sale. The eye of the seller in the marketplace is a special element of successful sales. We know that the marketplaces are special social institutions where an experienced seller promotes his product as “absolutely good” without interfering much with the competition. However, we know that consumers in the marketplace have previous experiences, so attraction can only be done through the visual image of the point of sale.

Modern living conditions in urban areas impose continuity in the supply of fresh agricultural products as a condition. Dynamic living in urban areas poses an additional challenge to survival (Bott et al., 2019). They (marketplaces) contribute to many social benefits, increase income, social communication and interaction, development of social wealth, as well as a stronger degree of connection between consumers and the local community. (Bonanno et al., 2017). There is an introduction of innovations in agricultural production and sales. Future research must comprehensively conceptualise the interaction between consumers, labels and trust in order to provide a complete picture of how trust works in relation to product labels. (Tonkin et al., 2015). Labels can often increase sales due to the display of various slogans (eg safe for tuna, healthy environment, etc.), especially for those consumers who are environmentally aware and who are willing to pay more for such a product. (Teisl et al., 2002; Zahirović et al., 2021). The supply chain of agricultural products implies an integrated interest within the chain starting from agricultural producers, marketplaces, local urban community, consumers and the social community.

Material and methods

The central problem that we analyse in the paper is the design of an integrated model of personal sales, which would include all types of communication processes and thus be the result for solving various problems. The operational problem of the research is personal sales that arise directly on the marketplace, but also in academic, professional and business circles that deal with personal communications. The problem is reflected in the fact that so far no coexistent and comprehensive model of marketplace sales on the marketplace has been defined. Thus, sellers are not aware of what belongs to that model and are not aware that they use various instruments to convey information about themselves and their offer. Building the seller's image and sales success depends on the communication process, especially in the market, because communication takes place before the purchase process (direct marketing) in the form of interactive communication and directly through sales and sales promotion as well as living words (Karavelić et al., 2021). The aim of the theoretical part is to design a conceptual model of integrated marketing communication, which would show the complexity and connectivity of all elements in the communication process. It is also the goal of designing a usable communication model with answers to the questions of all participants in the model, marketing the communication model in the marketplace sales process based on consumer satisfaction. Marketing research is a function that connects consumers, customers and the general public with the marketer through information - and that information is used to identify and define marketing opportunities and problems, to design, improve and evaluate marketing actions, to monitor marketing performance and to improve the understanding of marketing as a process. (Kotler et al., 2017).

The implementation of research objectives is based on the application of marketing research methods. The theoretical aspect of the research is based on the application of existing literature, authors' experience and existing communication models. Data

for qualitative analysis of data were obtained by the method of testing through a questionnaire at the Fish Market in Novi Sad, Zeleni Venac in Belgrade and Niš Green Market Tvrđava. Of the special methods of cognition, methods of analysis and synthesis, logical deduction, statistical data processing and tables are used. The intention is to apply the set methods to achieve an effective theoretical model of communication by studying the existing literature and starting from the research problem, and based on the results of empirical data, set the following hypotheses.

The total number of surveyed sellers who agreed to fill in (to answer) to the survey questionnaire is 75, of which 25 of the sellers were from the each of the three marketplaces that were the subject of the survey. This sample represents about 50% of the size of the possible sample if the approximate number of vendours coming to the marketplace for a minimum of 5 days is taken into account. The research was conducted on green markets. The aim of the research is to bring the common interest closer in the time of global marketplace conditions, huge competition and everyday communication between sellers and consumers. The problem of research is personal sales, on which the success of sales depends, as well as communications based on modern information technology, but also the attitudes of consumers. Today, consumers are more and more educated and informed, who rightly set higher standards in the field of purchasing products that affect the quality of life. When it comes to consumers who were surveyed on a sample of 50 at each market, the survey can be considered relevant because the content of the questionnaire was structured so that consumers who come to the marketplace at least 3 times a week answered. The analysis also includes the number of people who deal with marketing and communications in the three subject market administrations. We expressed that as a share in the total number of employees in companies. The average number of employees involved in marketing and communications is 5.5%, which is quite low compared to the total number of employees.

Based on the data of the Association of Marketplaces of Serbia, the number of employees who actively participate in the promotion of markets on the market is quite low, considering the aggressive marketing activities of the competition.

The intention is to look at the overall interest in selling agricultural products on the marketplace from the point of view of marketplaces, sellers and consumers and point to the fact of increasing the number of employees in marketing, thus resulting in the application of new forms of behaviour and the sellers themselves. Hypothesis H3 will examine the marketplace awareness of consumers and their willingness to change their buying behaviour and change the behaviour of sellers in sales.

The intention is to apply the set methods to achieve an effective theoretical model of communication by studying the existing literature and starting from the research problem, and based on the results of empirical data, set the following hypotheses.

H1: Marketplace vendours do not make enough use of marketplace sales in sales - sales vendours do not use personal communications as a concept of efficient sales.

H2: The sellers in the marketplace do not sufficiently fulfill the wishes and expectations of their consumers.

H3: Consumers in the market have a positive attitude about the potential change of sellers and their own behavior in shopping - the average desire for changes in the behavior of sellers in sales and consumers in shopping.

Results of empirical verification

Analysis of research of the marketplace sellers

95% of sellers who have been selling at the marketplace for more than 10 years answered the questions from the survey conducted on the three marketplaces in question. So this research can be considered relevant because it is about salespeople who have a wide range of knowledge in sales and thus the social and societal roles of markets. Based on the experience of the authors and the data that have been verified in terms of the years spent on the marketplace, the data can be considered realistic. Based on the set hypotheses of the research in the empirical part, the connections between the sellers on the marketplace and the attitudes and behaviour of consumers when shopping will be studied.

Table 1. Personal sales - the most important communication instruments of marketplace vendours

Communication through sales promotion	81%
Point of sale communication	74%
Personal sales-word-of-mouth -direct marketing	49%
Communication with well-known and loyal customers	45%
Significance and place of the marketplace	41%
Consumer attitudes	43%
Internet sales and communication	36%
Sales and marketing events in the marketplace	27%

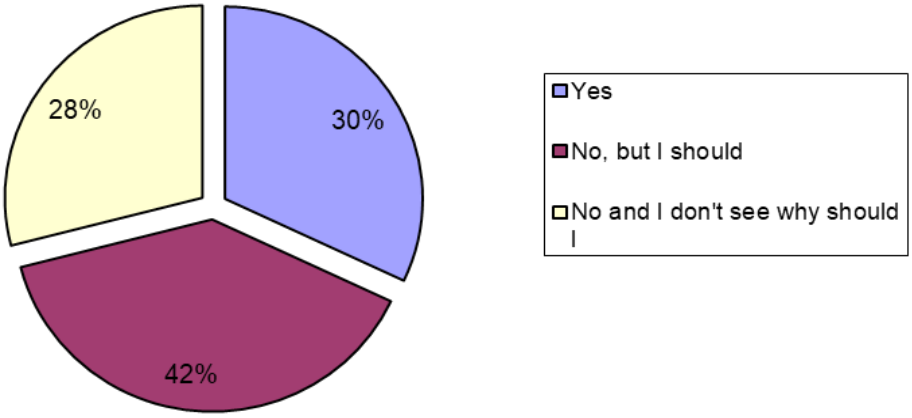
Source: Author's research

Vendours' attitudes (Table 1) on the most important communication instruments allow us to draw conclusions from H1.

Based on the attitudes of sellers about the use of marketplace sales in sales from the above research, we see that they do not use marketplace sales enough. Thus, we realise that hypothesis H1 has not been confirmed. Thus, marketplace sales in the form of personal sales, direct marketing and live words were not sufficiently applied by sellers, which would manifest the success of communication in higher sales. Salespeople attach great importance to sales promotion and point-of-sale communication, but they are ad hoc sales attempts based on the author's experience and conversations with salespeople. They are not part of a personal communication strategy. From this it can be concluded

that the strategy of personal communication of sellers is necessary as a prerequisite for successful sales and business success. The success of the seller's communication can be determined in different ways, i.e. from different aspects. The success of the seller's communication from the aspect of economic stability and weather relations with consumers will be observed, considering the instruments of sales promotion, direct marketing and living words from a position that can increase and contribute to the seller's reputation and market position.

Figure 1. Implementation of the concept of personal sales (database)



Source: Author's research

Conducted research with sellers of agricultural products on the marketplaces in question when it comes to the implementation of the concept of personal sales in the form of maintaining a database of consumers based on the survey are as follows:

• Yes, I have the database formed - 30%

• No, but I should introduce it - 42%

• No, and I don't see why should I keep the records - 28%.

Based on the communication findings during the survey, a large number of sellers keep a database, but they are quite out of date and superficial. These databases are only lists that are not kept in the internal and online database of vendours. And from this test of H1 hypothesis, it is clear that vendours do not keep systematic databases. Therefore, they are not able to use data from the database for sales purposes, so it can be concluded that the element of personal communications, performed through direct marketing in the form of a database is not adequately applied. Therefore, hypothesis H1 has not been confirmed.

Respondents surveyed in response to the question from Hypothesis H1 were able to give an answer on a scale of 1 to 5, where 1 expressed a negative opinion and 5 a distinctly positive one. According to the data in Table 1, the average assessment of the insufficient use of marketplace sales in sales is 2.5 in the area of all three subject marketplaces.

Table 2. Data on the average assessment of the application of personal communications

	N	Mean	Stand. deviation	Std. Error Mean
Insufficient application	150	2.5	0.760	0.0764

Source: Author's research

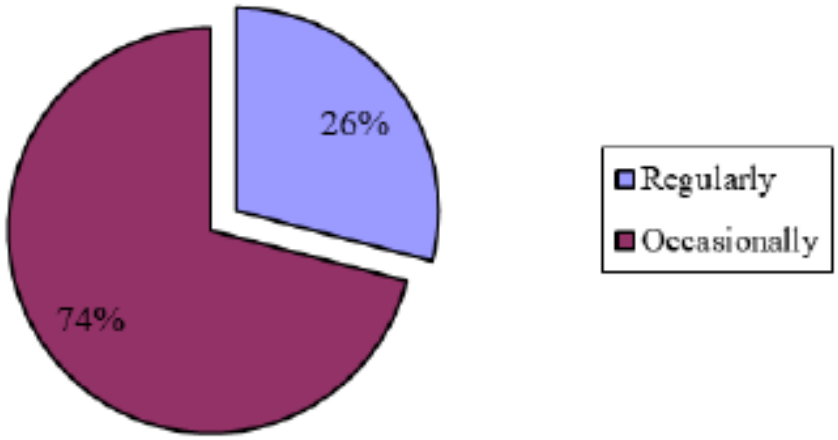
Table 3. One sample test, average score of personal communication application (close value = 3).95% Confidence interval of the Difference

	t	df	Sig.(2-tailed)	Mean Difference	Lower	Upper
Insufficient application	-6.185	148	0.000	-0.478	-0.6112	-0.3256

Source: Author's research

According to the data of empirical verification, where the significance is a * = 0.000 = 0%, and * <5%, which shows that the average value, the assessment of insufficient use of personal communications, is different from the tested value, so it can be concluded that accept the hypothesis that the average score of the application of marketplace sales in all three marketplaces is 3 since it is equal to 2.5 in the sample, which means that it is less than 3.

Figure 2. Control of personal communication strategy



Source: Author's research

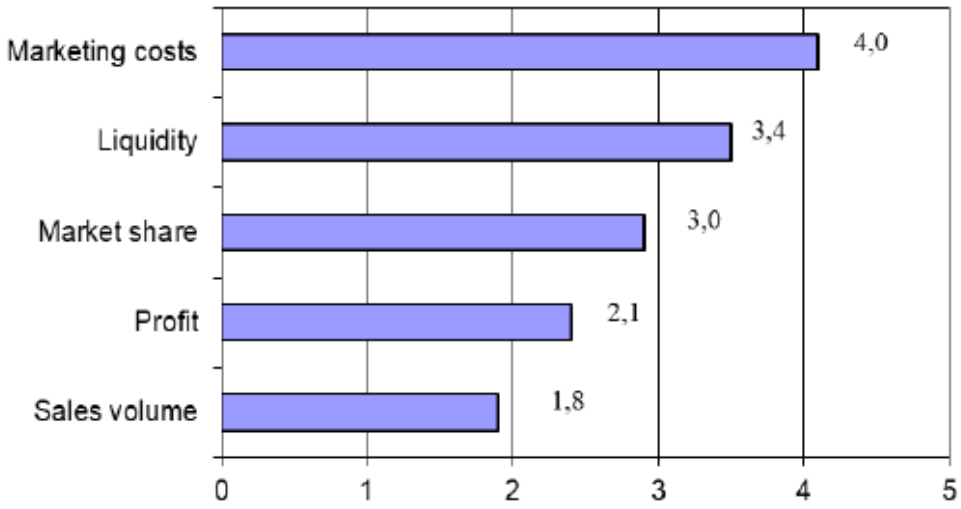
Researching the success of personal sales control in the measure of fulfilling the wishes and expectations of its consumers with the surveyed sellers of fruits and vegetables, the results are quite unsatisfactory. Only 26% of the surveyed sellers regularly control the adopted communication strategy and 74% do not.Control of personal communication is the most important act without which it is not possible to accurately determine and specify the results of communication and sales.The results of the research indicate that the control of the adopted strategy of personal communication is not implemented,

so the sellers have to face it and look for solutions, especially when observing the marketing activities of competing companies.

The following elements were used to measure the results of marketing control:

- Sales volume 1.8%
- Profit 2.1%
- Market share 3.0%
- Liquidity 3.4%
- Marketing costs 4.0%

Figure 3. Instruments for measuring personal sales control



Source: Author's research

It should be noted that the importance of measuring individual instruments has been recorded so that 1 is the most significant factor and 5 the least significant. From the mentioned research, it is clear that marketing costs are the least important item in measuring the achieved sales results. There is no awareness among sellers that the strategy of marketing control of marketplace sales can increase sales and achieve other business results. Namely, the strategy of successful personal communication, which ultimately increases the business result, cannot be achieved either through the control of the personal communication strategy, which is conducted to a very small extent, or the importance of marketing costs with sellers on the marketplace. H1 has not been confirmed from the above paragraphs.

When it comes to the second hypothesis H2 in which sellers in the marketplace do not sufficiently meet the wishes and expectations of their consumers, we will look through the prism of implementing the concept of communication and measuring their effects on sales. As one of the predictable consequences of communication and fulfillment

of consumer desires in our research model, is a higher level of service by sellers. The perceived quality is shaped as a consequence of fulfilling the wishes and expectations of its customers. The expected level of consumer satisfaction is significantly influenced by personal communications.

Table 4. Data on the average assessment of consumer satisfaction by changing the attitudes of sellers

	N	Mean	Std. Deviation	Std. Eror Mean
Consumers' attitude	150	3,8	,6630	,07661

Source: Author's research

Table 5. One sample test, average consumer satisfaction rating (close value = 4).95% Confidence interval of the Difference.

	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Consumers' attitude	-0.078	148	0.926	-0.00504	-0.11332	0.1232

Source: Author's research

According to the obtained empirical research data a*=0.926=92.6%, and a*>5%, which shows that the average value, the assessment of changing sellers according to the requirements of their consumers, does not differ from the tested value, so it can be concluded thatcan accept the hypothesis that the average assessment of the desire to change sellers on all three marketplaces is 4. Therefore, according to the obtained data, hypothesis H2 can be accepted.

Based on research, the degree of integration of personal communication based on H2 on changing sellers and in order to change behaviour based on consumer attitudes, we can measure through certain groups of variables depending on the goals of communication through:

- Organisation of sellers observing the instruments of communication, knowledge of sales techniques and cooperation with marketplace administrations
- Interactivity reflected in the strategic coherence of communication, special programmes for fulfilling consumer desires, measuring realised consumer desires and consumer databases
- Vision of communication within the communication plan, social care, sales focus on healthy and safe products
- Strategic analysis of communication harmonised with the position on the marketplace and the position of the marketplace on the wider market, shaping intensive internet communications at the center of the external message
- Planning communications in the special part of personal communications, planning communications with regard to consumer needs, planning the offer

of healthy products, researching relationships with consumers, using personal communication instruments and designing sales programs based on dialogue with consumers.

In order to maintain the trust of customers, bidders must invest special marketing efforts in raising confidence in their products, as well as improving other activities that are not directly related to the product but contribute to its better sales. (Zarić et al., 2016).

If we apply the above in market sales, it is clear that sellers must make an effort to form a marketing mix that will be used as their own source of competitive advantage. Competitive advantage in market sales depends on the unique elements of supply, competition and consumer needs. Constant monitoring of variables keeps, loses or gains an advantage in a short time. Producers largely do not adhere to the appropriate agricultural production techniques. (Vlahović et al., 2016). Integration of product offer - through the development of agricultural clusters, strengthening farmers' associations, promotion of agricultural cooperatives; only by uniting do farmers have the ability to make up for what each of them lacks (finance, cheap inputs, modern machinery and technology), with a significant increase in their bargaining power - both vis-à-vis the state and the food industry, trade and exporters. (Paraušić i et al., 2007).

By analysing the global market and the age in which we live and work, we come to the conclusion that the technology of production and supply must be part of an organised market. The concept of supply integration can be successfully implemented in the concept of production and sales. With certain efforts in the financial, organisational, technological sense, the marketing effort will be the basis of the competitive advantage of agricultural producers. All subjects of production and sales on the domestic market should work on the principles of socially responsible business in the future.

Analysis of consumer research in the marketplace

Researching the attitudes and perceptions of fruit and vegetable consumers in the marketplace enabled knowledge and preferences, motives for buying products as well as the adoption of certain communication strategies to increase sales. By comparative analysis of consumer attitudes as well as the appropriate marketing strategy of marketplace salesof the seller's business, it is possible to predict and adjust the marketing strategy of marketplace salesto the needs and desires of consumers in order to establish long-term relationships with consumers.

Table 6. Demographic and socio-economic characteristics of consumers in the marketplace

Gender/Sex	Women	105	70%
	Men	45	30%
Age	18-30	28	25%
	31-40	35	23%
	41-50	49	32%
	51-60	18	12%
	Over 60	10	8%

School level	PhD/master	8	5%
	High	40	27%
	Higher/third degree	28	19%
	Medium	62	41%
	Lower	12	8%
Status	Employed on a long-term basis	65	43%
	Employed on a part-time basis	24	16%
	Unemployed	19	12%
	Student/pupil	19	12%
	Retired	23	17%
Own source of income	Yes	99	66%
	No	51	34%
Monthly income per household	Up to RSD 35,000	34	22%
	From RSD 35001 to 52000	48	32%
	From RSD 52000 to 62000	49	33%
	Over RSD 62000	19	13%
Work field	Industrial production	33	17%
	Public sector	52	26%
	Education and science	32	16%
	Trade sector	37	19%
	Insurance sector	8	4%
	Catering	29	15%
Type of activity	Agricultural	18	12%
	Non-agricultural	88	59%
	Mixed	44	29%
Number of household member	One member	2	13%
	Two members	38	25%
	Three members	46	31%
	Four members	31	21%
	Five members or more	15	10%

Source: Author's research

The structure of the sample according to demographic characteristics of gender, age, education is given in the table (Table 6). The results of the research show that 70% of the consumers in the marketplace are women and 30% are men. When it comes to age structure, they are mostly middle-aged people who range from 30 to 50 years old. When we look at the sample of respondents according to employment and monthly household income, we come to the conclusion that the standard of living in our country is low. This statement is confirmed by the data from the research that 54% of respondents have a monthly income below the national average if we take incomes up to 52,000 thousand dinars for that average. The analysis of the research results shows that it is necessary to use market segmentation based on a combination of several criteria as a basis for choosing a personal communication strategy. In addition to the tools of the marketing mix, it is necessary to combine demographic and psychological criteria. Namely, in order to choose an adequate personal communication strategy, it is necessary to know about the attitudes and perceptions of consumers. Direct marketing, sales promotion and live word are very effective, for establishing partnerships between sellers and consumers in the marketplace.

Table 7. Data on the average assessment of consumer change (sellers-consumers).

	N	Mean	Std. Deviation	Std. Error Mean
User change	150	3.989	0.637	0.0641

Source: Author's research

Table 8. One sample test, assessment of changing user behaviour (close value = 3.8).95% Confidence Interval of the Difference

	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
User change	3.031	148	0.003	0.1954	0.0667	0.3122

Source: Author's research

According to the obtained empirical verification data, a*=0.000=3=q,3, a*<5, which means that the average estimate of the change between sellers in sales and consumers in purchases differs from the tested value. So it can be concluded that the hypothesis that the average desire for a change in behaviour in the whole set is 3.8 cannot be accepted. The hypothesis that the average assessment of the desire for a change in behaviour in the whole set is 3.8 cannot be accepted, since it is equal to 3.989 in the sample, which is greater than 3.8.From the above, it can be concluded that hypothesis H3 was not accepted.

Thus, consumers in the marketplace do not have a positive attitude about the potential change of sellers and their own behaviour in shopping. In the future, it is necessary to maintain continuous research on consumer attitudes and adjust your offer accordingly. It is desirable to expand the range of existing offers based on social and demographic characteristics of consumers. That is why an increasing number of companies are not only innovating their products and processes in accordance with environmental requirements, but are also working on continuous education and consumer information and creating segments with a new lifestyle (Ottman, 2011).

Consumer characteristics and attitudes imply a strategy of personal communication transformation that is focused on selling fresh and healthy products. The effects of this application are conditioned by the differentiation of consumers according to their wishes and preferences in terms of market value. The producers expressed their satisfaction with the profile of customers who come to the marketplace, because most of them are customers who know what an eco-product is and who know what they want to buy (Šiljan et al., 2017).

Lately, there has been a consumer preference, driven by lifestyle and awareness of the importance of the environment and its preservation. Global time has identified a number of negative activities that affect the environment. That is why the concept of production of organic healthy products is primarily important for sale on the marketplace. Consumers are also not willing to sacrifice product quality and performance, nor are they necessarily willing to pay a premium price for "green" products (Lin et al., 2012).

In accordance with the elements of its own budget, the consumer buys organic products in the form of criteria generated by innovation and differentiation in sales. Starting from the fact of stimulation for the purchase of organic products, the basic goal of marketplace sales of sellers is to create messages that give the true value of the product. Since only 5.5% of employees in the marketplaces in question are engaged in marketing and communications, the strategy of marketing channels should be created in a way that emphasises the importance of marketplaces for the sale of fresh and organic products.

Research recommendation

Modern tendencies provide a chance for marketplaces to develop while preserving their traditional social role. When it comes to domestic marketplaces in question, in which only 5.5% of employees are engaged in marketing, a change in access to the marketplace is required. It is known that the Republic of Serbia has key resources in agriculture, so it is necessary to achieve a significant competitive advantage in the domestic, regional and global markets and develop its own brand of fruit production and vegetables as well as organic products. This research also has certain limitations. The restriction can be placed in the context of the sample size in relation to the number of markets in the Republic of Serbia. Therefore, in future research, it could be recommended to conduct a new research on a much larger sample in order to make the results more representative. New research, over a longer period of time, would contribute to consistency and greater reliability of results.

Conclusion

The aim of this study was to determine the degree of interdependence of marketplace sales used by sellers in order to increase sales based on the wishes and expectations of their consumers. The goal is also how consumers in the marketplace can influence sellers and their own positive attitudes with their behaviour. In addition, the goal is to establish attitudes that can contribute to successful communication and sales, and ultimately contribute to the overall social scale of values that can arise from good communication. The results of empirical research in the practical application of marketplace salesare insufficient and different in the tested value of hypothesis H1. The tested value of the assessment of the application of marketplace salesis 3, while in the sample it was 2.5, which means that it is less than 3, so the hypothesis was not accepted, based on which the conclusion is that sellers use personal communications to a sufficient extent. When it comes to hypothesis H2, the assessment of changing sellers at the request of their consumers does not differ from the tested value, so it can be concluded that sellers want to change at the request of their consumers, since the average assessment of willingness to change does not differ from the tested than in all three marketplaces 4. In hypothesis H3, on the desire to change the attitudes of sellers in sales and consumers in shopping, we see that the average tested desire to change is 3.8. The average score of behavioral changes is 3.9, which is greater than 3.8. The conclusion is that there is no desire for changes in the behaviour of sellers and buyers in the whole set, so H3 was not accepted, due to insufficient desire for changes in behaviour.

The results of empirical research show that changes in the marketing strategy of selling agricultural products to sellers are necessary. The result of a change in the marketing strategy of marketplace sales must be compatible with the identified attitudes of consumers. It is necessary to harmonise personal communications in sales through direct marketing, sales promotion and words-of-mouth with consumer requirements. In that sense, to increase the sales efficiency, it is necessary to identify the personal needs of consumers, but also specific needs through social responsibility. Personal needs should be identified through personal motives for shopping, financial, product quality, health care, but also social through corporate social responsibility, taking into account a healthy environment.

Since the effect of personal sales is insufficiently researched on the domestic market, this research can be considered as a good start for future research. Choosing a good strategy of marketplace salesof sellers will lead to connecting different interests in the supply chain of fresh agricultural products in the marketplace. The development of modern information technologies enables the connection of marketplaces, sellers and consumers in the supply chain, so sales can be made more efficient. Connecting all interested parties will enable the institutional solution of the problem of the work of the market and emphasise the traditional, social and demographic value for domestic sellers and consumers, and increase the overall sales effect of the marketplace.

Conflict of interests

The authors declare no conflict of interest.

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CORRELATION ANALYSIS OF THE CRUDE OIL, GOLD AND STEEL PRICES FOR THE PURPOSE OF AGRICULTURAL DEVELOPMENT

Dejan Jeremić[1], Slobodan Stanojević[2], Milan Mihajlović[3], Biljana Ivanova[4], Radan Kostić[5], Nataša Marjanović[6]

**Corresponding author E-mail: office@sequesteremployment.com*

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ABSTRACT

This paper investigates the relationship between oil, gold and steel prices observed over a period of ten years with the aim of presenting their situation and trends using statistical methods and time series over a longer period of time and their impact on agricultural development. The high share of agriculture in the basic macroeconomic aggregates of the Republic of Serbia conditions that agriculture has a significant role in the foreign trade of the Republic of Serbia, especially in exports. The negative trend of rising fuel prices per farmer reduces the average fuel consumption per hectare. Also, the growth of the price of steel is conditioned by the growth of the prices of agricultural machinery.

Introduction

Achieving energy efficiency of developed economies is conditioned by ensuring security of supply of raw materials in order to avoid shortages and reduce competitiveness

1 Dejan Jremić, Associate Professor, Sequester Employment, Đušina 9, Belgrade, Serbia, E-mail: office@sequesteremployment.com, ORCID ID(https://orcid.org/0000-0001-9089-9467)

2 Slobodan Stanojević, Associate Professor, Faculty of Applied Management, Economics and Finance, Jevrejska 24, 11000 Belgrade, Serbia, E-mail: slobodan.stanojevic@mef.edu.rs, ORCID ID(https://orcid.org/0000-0002-1845-7119)

3 Milan Mihajlović, Assistant Professor, Military Academy, University of Defence, Pavla Jurišića Šturma 33, Belgrade, Republic of Serbia, e-mail: milan.mih83@gmail.com, ORCID ID (https://orcid.org/0000-0001-7949-2631)

4 Biljana Ivanova, Assistant Professor, Military Academy, University of Defence, Pavla Jurišića Šturma 33, Belgrade, Republic of Serbia, e-mail: biljana.ivanova70@gmail.com, ORCID ID(https://orcid.org/0000-0002-4722-770X)

5 Radan Kostić, Assistant Professor, Military Academy, University of Defence, Pavla Jurišića Šturma 33, Belgrade, Republic of Serbia, e-mail: kostic.radan1976@gmail.com, ORCID ID(https://orcid.org/0000-0002-1642-1278)

6 Nataša Marjanović, Assistant Professor, Business School of Vocational Studies, Gradski park 2, 11000 Belgrade, Serbia, e-mail: natasa.marjanovic@hotmail.com, ORCID ID(https://orcid.org/0000-0003-3791-5135)

(Avakumović et al., 2021; Leković et al., 2022). The price of raw materials is one of the most important factors in the structure of production costs and an indicator of the scarcity of these raw materials in a given market even in agriculture (Gleich et al., 2013; Vujović & Vujović, 2021). The properties of metals such as gold and steel and oil as strategic raw materials justify the economic importance of researching the mutual influence of their prices(Hooker, 2002; Mihajlović et al., 2020; Ristić et al., 2021).

The market for these metals and oil has evolved and reached a certain level of development and interaction. The value of these metals and oil has been expressed in dollars for the longest period of time, and for gold it is important to note that until the 1970s, the dollar was converted into gold. This convertibility has affected the economic stability of rare metal and oil prices, so that the cessation of convertibility will lead to a period of price instability even and agriculture products, which is still characterized by a trend of monitoring oscillations in the same direction (Simakova, 2011; Tekić et al., 2021).

Methodology

In this paper, the price predictions of oil prices are correlated with the values of gold and steel prices from June 2008 to June 2018. This period at the very beginning includes the period of crisis in 2008, when the price of crude oil had a constant growth. In July of that year, the price of crude oil was 147.27 USD / bbl (Lang & Auer, 2019). Data on crude oil price movements used in this study refer to WTI crude oil prices on the New York Stock Exchange (NYMEX). The prices formed for the purchase of the nearest futures contract at the end of the working day were taken and are expressed in USD / bbl. Gold and steel prices were taken from the Macrotrends database. The number of observations is 2538 for each of these three resources. All data in this part of the analysis will be processed in the statistical program EVIEWS.

To select the models that best describe the movement of crude oil prices, methods of minimizing information criteria were chosen, specifically Akaike's, Schwarz's and Hannan-Quinn's information criteria, as well as the minimum standard error criterion, according to Kovacić (1995) and Mladenović and Nojković (2012). The information criterion is the sum of two components that react differently to changes in the number of model parameters (Dukić-Mijatović et al., 2021; Ilić & Tasić, 2021; Paspalj & Brzaković, 2021). Criteria for selecting the optimal set of explanatory variables, which is common for time series models, are the lowest values of the information criterion. In order to explain the time series, it is necessary to provide information about its basic properties. Prediction is based on the chosen model, but business in unstable economies should not be overlooked. It is recommended that, in addition to common sense, more models be used, as well as correlation and regression analysis, which are the basis of many statistical techniques (Savić & Obradović, 2020). Correlation and regression analyze the associations of different phenomena, which are represented by the values of two or more random variables. The association of random variables implies that changes in one variable are followed by changes in another variable. Correlation analyzes the strength and direction of the connection, while regression also analyzes the form of

the connection, and also enables the prediction of the dependent variable based on the values of the independent variables (Chiroma et al., 2015; Mihajlović et al., 2018).

There are several tests to detect the order of differentiation, ie how many times a series needs to be differentiated to become stationary, but a graphical representation and correlations of series levels and first, second and third differences, minimum standard deviation and square root test will be used. Then, using the Durbin-Watson statistics, the existence of autocorrelation will be checked, that is, the correlation between the values of the time series at different time points.

Gold price analysis

The time series of gold prices is not a stationary series, which can be seen from its correlogram. From December 2008 until June 2011, the series has a tendency to grow, after which the decline and growth of data values alternate. The same conclusion about the non-stationarity of the series is made on the basis of the review.

Table 1. Choreogram of the gold price series

	Autocorrelation	Partial correlation	Q- statistic	Probability
1	0.997	0.997	2530.2	0.000
2	0.995	0.024	5049.2	0.000
3	0.993	0.016	7557.6	0.000
4	0.990	-0.006	10055	0.000
5	0.988	0.021	12542	0.000
6	0.986	-0.022	15019	0.000
7	0.983	-0.006	17484	0.000
8	0.981	0.018	19939	0.000
9	0.979	-0.016	22384	0.000
10	0.976	-0.015	24817	0.000
11	0.974	0.042	27240	0.000
12	0.972	0.000	29654	0.000
13	0.970	0.029	32058	0.000
14	0.968	0.003	34453	0.000

Source: Authors' calculations(http://www.macrotrends.net/)

For that reason, it is necessary to differentiate the series in order to obtain a stationary series that can be modeled. The question is how many times it is necessary to differentiate this series in order to get its stationary presentation. There are several tests to detect the order of differentiation of a series. The following three are most often used in the literature(Popp et al, 2018):

1. graphic presentation of the original values of the series and its correlogram as well as graphic presentation of the first, second and third derivative of the series and their choreograms;
2. the method of minimum standard deviation and
3. the square root test.

It happens that these methods do not indicate the same order of differentiation, so the order of differentiation chosen from most methods is accepted.

Table 2. Choreogram of the first derivative of the gold price series

	Autocorrelation	Partial correlation	Q- statistic	Probability
1	-0.024	-0.024	1.501	0.221
2	-0.021	-0.022	2.617	0.270
3	0.015	0.014	3.176	0.365
4	-0.024	-0.024	4.615	0.329
5	0.033	0.032	7.356	0.195
6	-0.007	-0.007	7.477	0.279
7	-0.028	-0.026	9.487	0.220
8	0.026	0.023	11.180	0.192
9	0.040	0.042	15.216	0.085
10	-0.051	-0.049	21.911	0.016
11	0.000	-0.002	21.911	0.025
12	-0.034	-0.035	24.921	0.015
13	-0.001	-0.001	24.924	0.024
14	0.031	0.024	27.377	0.017

Source: Authors' calculations(http://www.macrotrends.net/)

Based on Table 2, it can be concluded that the first derivative of the series is stationary, so it is necessary to differentiate the series only once. Another way to detect the order of differentiation of a series is the minimum standard deviation, which is presented in Table 3.

Table 3. Basic statistical indicators of series levels, first and second derivative

	X_t	ΔX_t	$\Delta^2 X_t$
Mean	1284.176	0.163633	-0.003448
Median	1269.550	0.200000	0.000000
Max	1896.500	80.75000	204.0000
Min	692.5000	-133.5000	-124.2500
Standard deviation	234.9398	14.56025	20.84109
Coefficient of skewness	0.183270	-0.648045	0.518382
Coefficient of kurtosis	2.895604	12.39897	11.08860
Jarque–Bera test	15.36024	9519.660	7032.412
Probability	0.000462	0.000000	0.000000
Number of observations	2538	2538	2538

Source: Authors' calculations

Table 3 presents the basic statistical indicators (mean, median, standard deviation, coefficient of kurtosis, which shows that it is flattened if less than 3 and the coefficient of skewness, which shows that it is asymmetric if it is greater than 0, etc.) price of gold X_t, the first derivative of the series price of gold ΔX_t as well as the second derivative of the series price of gold $\Delta^2 X_t$. According to the method of minimum standard deviation, it is necessary to differentiate the series once because the standard deviation of the series ΔX_t is the smallest (14.56025).

For the safety of the conclusion, it is necessary to conduct a square root test. In the square root test, zero and alternative (opposite assumptions) hypotheses will be set, which will be tested using one of three test statistics: τ_μ, τ_t or τ.(Rakić et al., 2021) The null and alternative hypotheses change from iteration to iteration during the square root test. In order to select the appropriate test statistics, the regression of the first derivative of the observed series to the constant is estimated, Table 4.

Table 4. Estimated regression ΔX_t on constant

	Coefficient	Standard error	t-Statistic	Probability
C (constant)	0.167901	0.288934	0.581103	0.5612
R^2 (Coefficient of determination)	0.000000	**Mean of dependent variable ΔXt**		0.167901
Adjusted R^2	0.000000	**Standard deviation of dependent variable ΔXt**		14.55897
Standard error of the regression	14.55897	**Akaike information criterion**		8.194686
Residual Sum of Squares	537963.7	**Schwarz information criterion**		8.196985
Durbin Watson Statistic	2.048369	**Hannan–Quinn information criterion**		8.195520

Source: Authors' calculations

Based on the results from Table 4, it can be seen that the constant in the observed regression is not statistically significant, ie that the trend at the series level is not statistically significant. For this reason, the τμ statistic test is used to test the unit root. The null hypothesis is set that the time series of gold prices X_t has one unit root (order of differentiation d = 1) versus the alternative hypothesis that the time series X_t is stationary (d = 0). The test statistic τ_μ represents the t-ratio from the regression ΔX_t depending on the constant and X_{t-1}(Bampinas & Panagiotidis, 2015). The results of this regression are presented in Table 5.

Table 5. Estimated regression ΔX_t depending on the constant and X_{t-1}

	Coefficient	Standard error	t-Statistic	Probability
C (konstanta)	3.403252	1.602897	2.123188	0.0338
X_{t-1}	-0.002520	0.001228	-2.052010	0.0403
R^2 (Coefficient of determination)	0.001657	**Mean of dependent variable ΔXt**		0.167901
Adjusted R^2	0.001263	**Standard deviation of dependent variable ΔXt**		14.55897
Standard error of the regression	14.54977	**Akaike information criterion**		8.193815
Residual Sum of Squares	537072.3	**Schwarz information criterion**		8.198415
F-Statistic	4.210744	**Hannan–Quinn information criterion**		8.195484
Probability (F-Statistic)	0.040271	**Durbin Watson Statistic**		2.046604

Source: Authors' calculations

Statistic τ_μ=-2.052010 is compared to the critical value τ_μ^k obtained according to the formula: $\tau_\mu = -2.8621 - \frac{2.738}{T} - \frac{8.36}{T^2}$ (1)

where T represents the number of observations, in our case 2538. Based on formula (1), τ_μ^k = -2.863201 was calculated. Since τ_μ^k is less than the calculated value of τ_μ, it is concluded that the time series X_t has one unit root, ie the null hypothesis is accepted. In the following, it is necessary to check whether the time series has more than one unit root, so the null hypothesis is set that the time series X_t has two unit roots compared to the alternative hypothesis that X_t has one unit root. Test statistics were obtained based on the corresponding t-ratio from the estimated regression $\Delta^2 X_t$ to constant and ΔX_{t-1}, Table 6.

Table 6. Estimated regression $\Delta^2 X_t$ depending on the constant and ΔX_{t-1}

	Coefficient	Standard error	t-Statistic	Probability
C (konstanta)	0.167692	0.289007	0.580236	0.5618
X_{t-1}	-1.024298	0.01985	-51.602990	0.0000
R^2 (Coefficient of determination)	0.512202	**Mean of dependent variable ΔXt**		-0.003448
Adjusted R^2	0.512009	**Standard deviation of dependent variable ΔXt**		20.84109
Standard error of the regression	14.55882	**Akaike information criterion**		8.195059
Residual Sum of Squares	537528.7	**Schwarz information criterion**		8.199660
F-Statistic	2662.868	**Hannan–Quinn information criterion**		8.196728
Probability (F-Statistic)	0.000000	**Durbin Watson Statistic**		2.007082

Source: Authors' calculations

Statistics τ_μ = -51.60299 are compared with the critical value τ_μ^k = -2.863201, where it is concluded that the null hypothesis is rejected, ie it is confirmed that the time series of gold prices, X_t must be differentiated once. So, the first derivative of the gold price series is modeled below. In order to determine the AR and MA components of the first derivative of the series, the choreogram of the first derivative is reviewed, Table 2 and it is concluded that it is a series of "white noise". The gold price series can be modeled as ARIMA (0,1,0):

$$\Delta X_{t-1} = e_t \quad (2)$$

According to McNeil at al (2005) and Francq at al (2010), white noise is a random component, which with deterministic components forms time series. White noise is very important, because, based on it, much more complex stationary processes have been built. In addition to the fact that white noise is a random component, its properties are that it is uncorrelated, as well as that it is poorly stationary.

Steel price analysis

Time series analysis is based on stationary assumptions. Stationarity implies that the moments of the series are constant over time. If there are structural fractures in the series, the values of these moments change at certain time points (on a specific date or dates). In this particular case, the effect of structural fractures will be analyzed using regression with structural fractures based on the Bai-Perron approach. This is a test for multiple fractures (more than one structural fracture in a series) that are not known in advance and that it is necessary to identify and determine their dates with a model.

The analysis included a series of steel prices from April 1991 to June 2018. Thus, in the observed period, after the absence of the trend and then the fall in the price of steel, their rapid growth occurred from the end of 2003 until the middle of 2008, when the price of steel reached its maximum. This trend can be explained by developments in financial markets when investors face rising volatility in the price of securities (stocks and bonds) and insufficiently attractive yields, which shifts their demand towards commodity markets, including the metal market. As a result, there is a growing demand for steel on world markets, as a result of which the prices of this metal are skyrocketing so that, from mid-2008 and in the next six months, they return to almost the same level as before the crisis. However, in the period after the outbreak of the global financial crisis, their volatility is much more pronounced and is evident until the end of the observed period.

Considering the described dynamics of the time series of steel prices, as well as on the basis of the review of its correlogram (Table 7), the conclusion is that it is a non - stationary time series.

Table 7. Correlogram of the steel price series

	Autocorrelation	Partial correlation	Q-statistics	Probability
1	0.998	0.998	6821	0.000
2	0.997	0.009	13622	0.000
3	0.995	-0.010	20403	0.000
4	0.994	0.036	27165	0.000
5	0.992	-0.008	33909	0.000
6	0.991	-0.007	40633	0.000
7	0.989	-0.037	47337	0.000
8	0.988	-0.013	54020	0.000
9	0.986	0.046	60684	0.000
10	0.985	0.002	67329	0.000
11	0.983	-0.041	73953	0.000
12	0.981	-0.069	80554	0.000
13	0.980	-0.008	87132	0.000
14	0.978	0.012	93686	0.000

Source: Authors' calculations(http://www.macrotrends.net/)

Since the procedure for identifying structural fractures in the series involves the prior construction of the AR (1) model, it is necessary to logarithm the observed series of steel prices, which achieves homogeneity of variance. Only after that it is possible to test the hypothesis of the existence of a unit root. In the formal expression AR (1) the model can be represented as follows:

$$y_t = \alpha + \beta y_{t-1} + \varepsilon_t \quad (3)$$

where α and β are the parameters of the model, while εt denotes the process of white noise, as a series of uncorrelated random variables of zero mean value and constant variance. The stationarity of the series implies that the parameters of the α and β models are constant over time. However, in the case of a structural break in the series, at least one of these parameters changes value on a certain date during the observed time period. Based on the conducted unit root test, it can be concluded that this is a non-stationary series. Table 8 shows the output of the test.

Table 8. Results of the ADF test of the logarithmic series of steel prices

Zero hypothesis: LNSTEEL *has a unit root*				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, maxlag=34)				
			t-Statistics	**Probability**
Dickie-Fuller test statistics			-2.454314	0.1270
Critical value test	1% level		-3.431128	
	5% level		-2.861769	
	10% level		-2.566934	

Source: Authors' calculations(http://www.macrotrends.net/)

By differentiating the logarithmic series, its stationarity is achieved, however, the presence of structural fractures in the series must not be abstracted in the modeling of this series. By neglecting the existence of structural fracture in the series, an overestimated estimate of the variance of the time series is obtained, while the estimates of ordinary and partial autocorrelation coefficients are biased. Also, the obtained forecasts are unreliable.

Table 9. ADF test results of the AR (1) model

Increased Dicky-Fuller test equation				
Dependent variable: D(LNSTEEL)				
Least squares method				
Sample: 4/15/1991 6/12/2018				
Number of observations: 6838				
Variable	**Coefficient**	**Standard error**	**t-StatisticS**	**Probability**
LNSTEEL(-1) [β]	-0.001688	0.000688	-2.454314	0.0141
C [α]	0.005638	0.002268	2.486587	0.0129
R^2 (Coefficient of determination)	0.000880	**Mean of dependent variable ΔXt**		0.000150
Adjusted R^2	0.000734	**Standard deviation of dependent variable ΔXt**		0.031132

Standard error of the regression	0.031121	**Akaike information criterion**	-4.101571
Residual Sum of Squares	6.620807	**Schwarz information criterion**	-4.099573
F-Statistic	6.023655	**Hannan–Quinn information criterion**	-4.100882
Probability (F-Statistic)	0.014140	**Durbin Watson Statistic**	1.989327

Source: Authors' calculations

Based on the results shown in Table 9, it can be seen that the segment on the ordinate, ie, the constant (α) and the parameter with the independent variable (β) are statistically significant. Namely, at the level of significance of 5%, the hypothesis that the parameters of the observed AR model are equal to zero was rejected. The next step is to identify the structural fracture, ie. fractures in series.

The Quantum-Andrews test starts from the assumption that a priori the period of structural fracture is not known, and therefore the existence of fracture in one or more time periods in the sample is studied. The corresponding null hypothesis assumes the absence of refraction. The basis of the test is to perform a single Cau (Chow) test at each point along the interval [λT, (1-λ) T]. After that all n test statistics of Cau tests are summarized and supremum F statistics are performed.

$$sup\ F\ =\ sup_{\tau\delta[\lambda T,\ (1-\lambda)T]}F\ ,\qquad t=1,2,\ldots,T \tag{4}$$

where τ is the breaking date, while λ is the trimming parameter. The truncation parameter (λ) is used because the distribution of statistics (equation above) becomes distorted as it approaches the beginning (λT) or end (1-λ) T] of the sample. For this reason, it is usually suggested that the first λT and last λT of the observed sample not be included in the testing process. As with the Cau test and the Quantum-Andrews test (1960, 1993), the null hypothesis that there is no structural fracture is rejected if the minimum F statistic is greater than the critical value.

In this particular case, a shortening parameter of 15% was selected. The procedure compared 4787 breakpoints. The results of the Quantum-Andrews test (1960, 1993) are given in Table 10.

Table 10. Quandt-Andrews test results

Null hypothesis: There is no breakpoint in the cut 15% of the data		
Sample equation: 4/15/1991 6/12/2018		
Test sample: 5/04/1995 5/08/2014		
Number of compared values: 4787		
Statistics	**Value**	**Probability**
Maximum LR F-statistics (6/26/2008)	9.735230	0.0015
Note: the probability is calculated using Hansen's method (1997)		

Source: Authors' calculations

The maximum value of the Cau test was determined for the time point on June 26, 2008. and it is statistically significant considering that the obtained value of the statistical significance test is less than 1% (p = 0.15%). This specifically means that the hypothesis that there is no structural break in the series was rejected. In the further course of the analysis, the Bai-Peron test (1998, 2003) will be performed, since the visual inspection of the series shows the existence of at least three different regimes in the movement of the observed series. The Bai-Peron test (1998, 2003) starts from the following model with multiple fractures:

$$y_t = x_t'\beta + z_t'\delta_1 + u_{t'} = 1,...,T_{1,},$$

$$y_t = x_t'\beta + z_t'\delta_2 + u_{t'} = 1,...,T_{2,}, \qquad (5)$$

.....

$$y_t = x_t'\beta + z_t'\delta_{m+1} + u_{t'} = T_m + 1,...,T$$

where y_t is the dependent variable at time t (steel price), X_t' i Z_t' predictor vectors, while β and σ_j are the corresponding coefficient vectors, and the error component. It is, in fact, a system of simultaneous equations, in which only σ_j coefficients are variable. Thus, based on the calculated Double maximum tests, UD_{max} and WD_{max}, the initial hypothesis should be tested, which reads:

$$H_0 : \sigma_j = \sigma_0 \qquad \text{za } j = 1,\ldots,m. \qquad (6)$$

In other words, we should test the hypothesis that the regression coefficients are constant, that is, that they do not change during the observed period, as opposed to the alternative that at least one coefficient varies with the passage of time. Also, the application of the Bai-Peron test (1998, 2003) implies that the time points of refraction (T_1, ..., T_m) are treated as unknown and estimated together with unknown coefficients on a sample of size T. Estimates of the coefficients β and σ_j were obtained by the method of least squares by minimizing the sum of the squares of the residue in the label $S_T(\hat{T}_{1,...,}\hat{T}_m)$, while the estimated breakpoints are obtained as:

$$(\hat{T}_{1,...,}\hat{T}_m) = \arg\min_{(T_{1,...,}T_m)} S_T(T_1,...,T_m) \qquad (7)$$

Table 11 shows the results of the application of the Bai-Peron test (1998, 2003) on the example of the observed series of steel prices.

Table 11. Bai-Perron test results

Breakpoint specification			
Breakpoint description used in the estimation			
Equation: EQ_BP			
Summary			
Estimated number of interruptions: 3			

Method: Bai-Peron test from 1 to M globally determined fractures					
Maximum number of fractures: 5					
Fractures: 11/18/1999, 12/18/2003, 8/05/2011					
Current breakpoint calculations					
Multiple fracture tests					
Bay-Peron test from 1 to M globally determined fractures					
Sample: 4/15/1991 6/12/2018					
Number of observations included: 6838					
Fracture variables: C					
Pause test option: Trimming 0.15, Maximum number of breaks 5, Sig. level 0.05					
Test of statistically used HAC covariance					
Enable the distribution of heterogeneous errors over interrupts					
UDmax set pauses:				3	
WDmax set pauses:				3	
		Scaled	Multiplied	Critical	
Fractures	**F-statistics**	**F- statistics**	**F- statistics**	**Value**	
1	5.438704	5.438704	5.438704	8.58	
2 *	26.94498	26.94498	32.02049	7.22	
3 *	29.49239	29.49239	42.45716	5.96	
4 *	14.67708	14.67708	25.23634	4.99	
5 *	12.17317	12.17317	26.71248	3.91	
UDMax statistics*		29.49239	*UDMax* critical value**		8.88
WDMax statistics*		42.45716	*WDMax* critical value**		9.91
* Significant at 0.05 level.					
** Bai-Peron (Econometric Journal, 2003) critical values.					

Source: Authors' calculations

Based on the results of the Bai-Perón test (1998, 2003), it was determined that the series has three statistically significant structural break dates (November 18, 1999, December 18, 2003 and August 5, 2011) which define four different regimes. steel price movements.

None of these dates correspond to the originally determined fracture date according to the Quantum-Andrews test (June 26, 2008). However, it should be borne in mind that tests such as the Quantum-Andrews test (tests to check for breakage in a series and when no break date is known in advance) can identify and evaluate only one break date in a series, which is a serious limitation. For that reason, the interpretation of the results of the Quantum-Andrews test should be reduced exclusively to checking whether there is a structural fracture in the series, after which the Bai-Peron test should confirm this finding, and then identify fractures in the series and determine their statistical significance(Kanjilal & Ghosh, 2017).

Crude oil price analysis

Over the last 60 years, large fluctuations in crude oil prices have often occurred. Although the market for all goods is determined by supply and demand, the crude oil market has

a political factor as a reflection of changes in power relations on the global geopolitical scene. For that reason, predicting the movement of oil prices is not a thankful task(Simić et al., 2021), because it is necessary in a certain way, using different models and methods, and based on the movement of crude oil prices in the past, to predict future price movements. Crude oil prices sometimes show sharp jumps and then sharp falls, which are the characteristics of major crises. After that period, they generally remain at a higher level than before the sudden jump(Aguilera & Radetzki, 2017).

The time series of crude oil prices is also non-stationary, which is confirmed by its correlogram (Table 12). The price of crude oil at the beginning of the observed period has the highest value (about 140 USD / bbl) since when it constantly begins to decline and in 8 months reaches a value of about 30 USD / bbl. The reason may be political in nature and some manipulations in the global market. Since February 2009, the price of crude oil has been constantly rising, but it no longer reaches the high value as at the beginning of the observed period. From the end of May 2014, the price of crude oil has been constantly falling again until the beginning of February 2016, when it reached a value of around 25 USD / bbl. The reasons may be similar to 2008.

Table 12. Correlogram of the time series of crude oil prices

	Autocorrelation	Partial correlation	Q-statistics	Probability
1	0.996	0.996	2517.1	0.000
2	0.993	0.032	5017.7	0.000
3	0.989	-0.001	7501.8	0.000
4	0.986	-0.003	9969.3	0.000
5	0.982	-0.030	12419	0.000
6	0.979	0.028	14853	0.000
7	0.975	-0.038	17269	0.000
8	0.971	0.023	19669	0.000
9	0.968	-0.009	22051	0.000
10	0.964	-0.025	24416	0.000
11	0.960	-0.003	26764	0.000
12	0.956	-0.001	29094	0.000
13	0.952	-0.042	31405	0.000
14	0.948	-0.037	33696	0.000

Source: Authors' calculations

Based on Table 12, it is clear that the time series of crude oil prices needs to be differentiated in order to obtain a stationary time series that can be modeled. The question of the order of differentiation that can be detected on the basis of the above-mentioned tests arises. By reviewing the choreogram of the first derivative of the series of crude oil prices, it can be concluded that the first derivative achieves stationarity in the series (Table 13).

Table 13. Correlogram of the first difference of the time series of crude oil prices

	Autocorrelation	Partial correlation	Q-statistics	Probability
1	-0.048	-0.048	5.781	0.002
2	-0.022	-0.025	7.0467	0.030
3	0.042	0.040	11.550	0.009
4	0.017	0.020	12.251	0.016
5	-0.058	-0.055	20.8660	0.001
6	0.053	0.047	27.894	0.000
7	-0.018	-0.017	28.697	0.000
8	-0.028	-0.023	30.683	0.000
9	0.027	0.022	32.496	0.000
10	0.000	-0.003	32.497	0.000
11	-0.018	-0.009	33.326	0.000
12	0.045	0.039	38.517	0.000
13	0.037	0.038	41.912	0.000
14	-0.037	-0.027	45.435	0.000

Source: Authors' calculations

Table 14. Basic statistical indicators of the level, first and second derivative of the time series of crude oil prices

	X_t	ΔX_t	$\Delta^2 X_t$
Mean	74.27978	-0.026780	0.000253
Median	76.37000	0.030000	-0.030000
Max	145.3100	18.56000	14.89000
Min	26.21000	-14.76000	-33.32000
Standard deviation	23.62546	1.650751	2.389628
Coefficient of skewness	0.059205	-0.054434	-0.794004
Coefficient of kurtosis	1.981827	14.34224	20.78302
Jarque–Bera test	110.8048	13568.08	33615.65
Probability	0.000000	0.000000	0.000000
Number of observations	2531	2531	2531

Source: Authors' calculations

If we observe the standard deviations of the level of the time series of crude oil prices, its first and second derivative, it can be concluded that the first standard deviation of the time series of crude oil prices, 1.650751, has the smallest standard deviation (Table 14). Therefore, this criterion also points to the conclusion that the time series of crude oil prices needs to be differentiated once. Of course, this conclusion must be verified by a unit root test. First, it is hypothesized that the time series of crude oil prices X_t has one unit root compared to the alternative hypothesis that time series X_t is stationary. The τ_μ statistic is used for testing because the regression constant ΔX_t on the constant is not statistically significant (Table 15).

Table 15. Estimated regression of the first derivative of the series of crude oil prices depending on the constant

	Coefficient	Standard error	t-Statistic	Probability
C (constant)	-0.026979	0.032800	-0.822524	0.4109
R^2 (Coefficient of determination)	0.000000	**Mean of dependent variable ΔXt**		-0.026979
Adjusted R^2	0.000000	**Standard deviation of dependent variable ΔXt**		1.650455
Standard error of the regression	1.650455	**Akaike information criterion**		3.840374
Residual Sum of Squares	6894.450	**Schwarz information criterion**		3.842679
Durbin Watson Statistic	2.095469	**Hannan–Quinn information criterion**		3.841211

Source: Authors' calculations

Table 16. Estimated regression ΔX_t depending on the constant and X_{t-1}

	Coefficient	Standard error	t-Statistic	Probability
C (constant)	0.246748	0.107944	2.285888	0.0223
X(-1)	-0.006383	0.001384	-2.661348	0.0078
R^2 (Coefficient of determination)	0.002792	**Mean of dependent variable ΔXt**		0.026979
Adjusted R^2	0.002398	**Standard deviation of dependent variable ΔXt**		1.650455
Standard error of the regression	1.648476	**Akaike information criterion**		3.838369
Residual Sum of Squares	6875.203	**Schwarz information criterion**		3.842979
F-statistic	7.082772	**Hannan–Quinn information criterion**		3.840041
Probability (F-statistic)	0.007832	**Durbin Watson Statistic**		2.093611

Source: Authors' calculations

The statistics τ_μ is equal to -2.661348 (Table 16) and is higher than the critical value τ_μ^k = -2.8632, so the null hypothesis is not rejected and it is concluded that the time series of crude oil prices has one unit root. The test statistic τ_μ is equal to -52.75178 (Table 17) and is less than the critical value τ_μ^k = -2.8632, so the null hypothesis is rejected and it is confirmed that the observed time series has only one unit root.

Table 17. Estimated regression $\Delta^2 X_t$ depending on the constant and ΔX_{t-1}

	Coefficient	Standard error	t-Statistic	Probability
C (konstanta)	-0.028071	0.032786	-0.856194	0.3920
DX(-1)	-1.047755	0.019862	-52.75178	0.0000

	Coefficient	Standard error	t-Statistic	Probability
R^2 (Coefficient of determination)	0.523886	**Mean of dependent variable ΔXt**		0.000253
Adjusted R^2	0.523697	**Standard deviation of dependent variable ΔXt**		2.389628
Standard error of the regression	1.649194	**Akaike information criterion**		3.839240
Residual Sum of Squares	6878.474	**Schwarz information criterion**		3.843852
F-statistic	2782.750	**Hannan–Quinn information criterion**		3.840913
Probability (F-statistic)	0.000000	**Durbin Watson Statistic**		2.001033

Source: Authors' calculations

In the following, the first derivative of the time series of crude oil prices is modeled based on the observation of the correlogram of the same (Table 13). The choreogram referred to several ARIMA models, of which the ARIMA model (6,1,1) was chosen because it was the best according to the criterion of minimum standard error and minimum Akaike information criterion. The estimated model is presented in Table 18 and has the form:

$$\Delta X_t = 0.0392\Delta X_{t-3} - 0.0541\ \Delta X_{t-5} + 0.0479\ \Delta X_{t-6} + e_t - 0.0415 e_{t-1} \quad (8)$$

Table 18. Estimated ARIMA model (6,1,1) for the crude oil price series

	Coefficient	Standard error	t-Statistic	Probability
AR(3)	0.039250	0.019852	1.977080	0.0481
AR(5)	-0.054090	0.019800	-2.731844	0.0063
AR(6)	0.047924	0.019811	2.419075	0.0156
MA(1)	-0.041466	0.019902	-2.08356	0.0373
R^2 (Coefficient of determination)	0.008808	**Mean of dependent variable ΔXt**		-0.027823
Adjusted R^2	0.007629	**Standard deviation of dependent variable ΔXt**		1.647768
Standard error of the regression	1.641471	**Akaike information criterion**		3.830645
Residual Sum of Squares	6795.344	**Schwarz information criterion**		3.839884
Durbin Watson Statistic	1.997284	**Hannan–Quinn information criterion**		3.833997

Source: Authors' calculations

Based on the evaluated model, it can be concluded that the price of crude oil at the observed moment (observed day) depends on the prices formed in the last seven days as well as random fluctuations in the market of the observed and previous day. For that reason, it is not possible to forecast the price of crude oil for a longer period of time, that is, the best results are in the prediction of the movement of crude oil prices in just one day.

Conclusion

The correlation between gold and crude oil is complex. Gold is an asset that is often used as a hedge against risk, an asset that preserves the value of assets and whose price depends largely on sensitive markets and inflationary developments. While crude oil is a risky raw material and its price depends on the balance that exists in the market between supply and demand for this resource. Crude oil and gold depend on and are largely conditioned by economic growth over time, but given that oil is the most sought after raw material and gold the most sought after precious metal, they play an important role in shaping the economy, even in agriculture. These means may show that there is a significant correlation, but it does not necessarily mean that they affect each other. Viewed through the analyzed period from 2008 to 2017, it can be noticed that there were time periods where the correlation was significant, as well as periods such as in the first quarter of 2016, when the price of gold rose by about 21%. During that period, the correlation between crude oil and gold was the lowest in that year, at -39%. The correlation was negative, because due to the fall in oil prices and the impact of fear on the global market, gold prices increased. Thus, a significant correlation may exist, but it does not have to be due to the influence of one good on another, but can be expressed as a result of some other variables, which may be common to both goods. The main conclusion is that the general level of gold prices is developing in the same direction as crude oil prices, but it should not be taken as relevant data for a longer period of time, although short-term patterns are emerging.

Agricultural production in which a significant amount of energy is invested depends on their price and availability to agricultural producers. In the observed period, the change in the price of crude oil significantly affected the reduction or growth of agricultural production, which was reflected in the total GDP of the country.

How important steel is for everyday life can be seen from the United States Geological Survey (USGS) on steel production and its impact on the global economy. According to their research, steel is the fourth most sought after metal in the world. In 2017, the largest steel producer in the world is China with about 843 million tons, followed by Japan with about 104 million tons, India with 99 million tons, the United States with 82 million tons, etc. In addition, the research results indicate that the two variables, crude oil prices and steel prices, have a cointegration effect. Time series have the property of cointegration, if the time series are non-stationary, and their linear combination is stationary. This property is important because economic time series move unpredictably over time, that is, they have a stochastic trend. Changes in the price of steel cause an increase in the prices of agricultural machinery, which significantly increases the costs of agricultural production. In a longer period of time, it reduces yields and total income on the basis of agricultural production.

Conflict of interests

The authors declare no conflict of interest.

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EFFICIENCY OF EGG PRODUCTION IN DIFFERENT ORGANIZATIONAL CONDITIONS

Jelena Đoković[1], Mihajlo Munćan[2], Tamara Paunović[3]

**Corresponding author E-mail: jdjokovic@agrif.bg.ac.rs*

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ABSTRACT

In the past few decades, egg producers have faced numerous difficulties, including reduced egg consumption due to consumer concerns about egg cholesterol content, egg production's adverse environmental effects, a ban of conventional cages for rearing layers etc. Therefore, egg producers in Serbia need to constantly monitor their business efficiency indicators and strive to manage costs. In this study, four farm models were formulated to analyze their production costs and to establish and compare the values of economic efficiency indicators, before and after the transition to an enriched cage system, as well as with and without the possibility to produce and process part of feed components for complete mixtures for layers. According to obtained results, transition to an enriched cage system on the observed farms would cause an increase in total production costs between 5.1 and 5.3% and the purchase of complete mixtures on the market, between 2.3 and 5.8%. Also, anticipated organizational changes would have a negative effect on most economic efficiency indicators, reducing them by 5.2–49.5%, but would also lead to productivity improvement for the farm with the semi-automated production process.

Introduction

Until 2020, egg production in Serbia was organized so that the laying hens were mostly kept in a conventional cage system, implying keeping layers indoors during the entire period of flock production, in completely controlled conditions in terms of lighting,

1 Jelena Đoković, Assistant Professor, University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Zemun, Serbia, Phone: +381114413406, e-mail: jdjokovic@agrif.bg.ac.rs, ORCID ID (https://orcid.org/0000-0003-4143-7957)

2 Mihajlo Munćan, Assistant Professor, University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Zemun, Serbia, Phone: +381114413416, e-mail: mmuncan@agrif.bg.ac.rs, ORCID ID (https://orcid.org/0000-0003-2359-8642)

3 Tamara Paunović, Assistant Professor, University of Belgrade, Faculty of Agriculture, Nemanjina 6, 11080 Zemun, Serbia, Phone: +381114413410, e-mail: tamara@agrif.bg.ac.rs, ORCID ID (https://orcid.org/0000-0003-4747-0678)

ventilation, nutrition, water distribution, manure removal and health care (available at: www.agroinfo). Although rearing layers in a conventional battery system requires significant investments, it also ensures a relatively quick refund and constant cash inflow during the production process which makes egg production profitable (Đoković, 2019). When it comes to facilities and equipment, modern technological solutions enable layers to reach their full production potential and allow the automation of the production process, with one employee rearing 15 to 50 thousand layers, resulting in the rationalization of labor usage (Milošević, Perić, 2011).

Nevertheless, the last few decades have brought more than one difficulty to egg producers. Initially, producers struggled with reduced egg consumption as a result of concerns by a large number of consumers regarding egg cholesterol content, which could potentially be harmful to their health. However, many research findings deny the connection between moderate egg intake and elevated blood cholesterol levels (Narahari, 2003; Nakamura et al., 2006; Jones, 2009; Virtanen et al., 2016; Abdollahi et al., 2019), and it will take much time until eggs take the place that they deserve in the human diet. This requires raising consumer's awareness of the importance of eggs in human nutrition, given that they are a source of useful proteins, fatty acids, vitamins and minerals (Applegate, 2000; Pavlovski et al., 2011; Miranda et al., 2015; Tolimir et al., 2016).

In the following years, this issue was accompanied by a number of problems related to environmental effects, especially ammonia emissions, followed by the health and safety of poultry workers and people living near poultry facilities regarding the potential transmission of zoonotic disease, as well as food safety, primarily potential for bacterial contamination in different housing systems (Mench et al., 2011).

However, focusing on hen welfare had the strongest impact on egg production. Images from poultry houses with a large number of layers reared in relatively small spaces, (usually cages), not being exposed to natural light for their entire life and not having freedom of movement, have contributed to the great expansion of alternative housing systems for layers in many countries (Rakonjac, 2017). Growing concerns about hen welfare led to the ban of conventional cages in the European Union from 2012 and transfer to enriched cages or some of the alternative housing systems. By 2016, in EU countries, 55.6% of the hens were housed in enriched cages, 25.7% in barn systems, 14.1% in free-range systems and only 4.6% in organic systems (Windhorst, 2017). Studies focusing on the implications of transfer to alternative housing systems have indicated a number of negative effects on egg production. The survey conducted in Belgium showed that a large number of Flemish egg farmers, almost 34%, terminated their business because of the ban on conventional cages and they experienced the time available to convert to a new housing system, as well as the communication from the government, as negative (Stadig et al., 2016). Also, as the main concerns arising from the transfer to alternative housing systems, Croatian farmers point out the increase in production costs, reduced competitiveness and unsatisfactory egg prices (Crnčan et al., 2014).

A similar study in Serbia showed that farmers were poorly informed about the transfer to alternative housing systems planned from 2020 and indicated the need for better awareness and understanding of hens welfare, banning the import of conventional batteries, providing support for investments in new equipment, developing an egg marking system and conducting consistent inspections (Rodić et al., 2014).

Many Serbian egg producers were burdened by a possible decrease in production cost-effectiveness and profitability due to the transition to an enriched cage system or one of the alternative housing systems, which required more comprehensive analyses of the economic efficiency of egg production in different housing systems (Đoković, 2019). This is why it was beneficial not only to examine and compare main business success indicators in different housing conditions but also in different organizational conditions.

Materials and methods

To achieve the research goals, several data sources were used. The most important data source was the financial and operational records of the observed farms for the production of table eggs. The data were collected and summarized in 2019, right before the mandatory transition to alternative housing systems. Data on natural and economic indicators of realized costs and business results, applied housing system for layers, mechanization and labor supply, organization of the production process, etc. were obtained by field research. It required direct observation, participant observation, qualitative interviews, using relevant documents and categorizing and analyzing collected data. Four farms, of different capacities, operating in different organizational conditions, were visited, in order to formulate a model for each one of them. Data were gathered on the observed farms by interacting with farm owners and their employees. Accordingly, the basis for further data processing was created through observations made on the farms and by studying and analyzing available production capacities, calculations and production plans, accounting records and financial plans, work standards and employee records.

Also, national and international statistical publications and databases of importance for the subject of research, such as the Food and Agricultural Organization (FAO), International Trade Center (ITC), the Statistical Office of the Republic of Serbia etc. were employed to gather data concerning production, prices of table eggs, reproductive materials and other inputs.

The main goal of the research was to establish and fully comprehend some of the factors (applied housing system, way to provide feed for layers and the level of automation of the production process) that contribute to achieving different levels of economic efficiency of farms for the production of table eggs and their quantification.

Consequently, the following assumptions have been made:

• The transition from a conventional to an enriched cage system affects the achieved economic efficiency of farms for the production of table eggs by reducing it, and

• Different organization of the production process, in terms of providing feed for layers and the automation of the production process, affects the level of production costs, and thus the level of achieved economic results on the observed farms.

Any comparison of absolute values of indicators implies the existence of identical production conditions for each observed organizational unit, which can certainly be provided in experimental conditions, but is almost impossible to find in production practice.

Accordingly, conducting this research first required the application of modeling method in order to ensure comparability of the obtained performance indicators and to neutralize the influence of subjective factors that affect business results. Therefore, the formulation of the model implied that all observed farms use the same layer hybrid and apply the recommended production technology, have the same flock production period. Similarly, calculations should be made with the same, average prices of all inputs and outputs, and under the same commercial and financial conditions.

Four models of egg production farms were formulated to enable description, prognoses and analyses of characteristics and achieved results, before and after changes caused by the ban of conventional cages and other organizational conditions, hereinafter – farms I, II, III and IV.

Models formulated based on observed farms for the production of table eggs involve maintenance of the same hybrid Lohmann brown-classic, the application of technology within standards recommended for this hybrid and the observation period of 57 weeks, from 18 weeks of age when laying hens were included until the 74th week of age when they were excluded from the production process.

HOUSING SYSTEM on the observed farms included rearing layers in conventional and enriched (furnished) cages.

The total capacity of farm I was 122,688 layers, which were equally distributed in six poultry houses. From a total of 3,456 enriched cages on farm I, 3,312 cages were categorized as large (for groups of 36 layers), and 144 cages as medium (for groups of 24 layers).

Farm II had 8,520 conventional cages designed for groups of 10 layers, amounting to a total of 85,200 layers. The cages were arranged in three larger poultry houses with a total capacity of 7,200 cages and a smaller one containing 1,320 cages.

Farm III had one poultry house with 1,200 enriched cages containing a total of 34,800 layers. Out of the total number of cages, 1,080 were designed for groups of 30 layers and categorized as large, while 120 were designed for groups of 20 layers, classifying them as medium.

Farm IV had organized production in three poultry houses with 6,528 conventional cages designed for groups of 5 layers. The total capacity of farm IV is 32,640 layers, distributed in two larger poultry houses containing 12,240 layers each and a smaller one containing 8,160 layers.

In accordance with modern achievements in the field of the automation of the egg production process, most of the work on farms I, II and III was automated when it came to food and water distribution, temperature and humidity regulation, manure removal, collecting, classing and packing eggs, as well as monitoring and control both at the level of individual poultry houses and the entire farm. On Farm IV, unlike other observed farms, some operations within the production process had to be performed manually, namely operations concerning monitoring and control, collecting and packing eggs, feed delivery from feed mixer to poultry houses, measuring feed quantity and managing the time of its distribution.

PRODUCTION VALUE was calculated based on the average price of eggs in the period of the production cycle provided by the Statistical Office of the Republic of Serbia and the prices for cracked eggs and hens excluded from production were calculated as the average of the prices that could be achieved by the leading processors of eggs and poultry meat and slaughterhouses on the domestic market during the production cycle. Farms sporadically generated revenues from the sale of poultry manure which were not included in the production value calculation since they were generally equal to or slightly below the costs incurred by manure removal.

EGG PRODUCTION COST DATA In accordance with the most commonly used methods of cost classification and methods of keeping records on the observed farms, the following cost classification was formulated and applied:

1. Production costs, which included the following categories.

a) Pullet cost – All observed farms used pullets from a commercial hatchery. The price of 18-week-old layers was calculated as the average price of the leading breeders on the domestic market in the observed period.

b) Feed cost –– Feeding mixtures used on the observed farms comply with the recommended nutritional composition standards for Lohmann Brown-Classic layers and were adapted to the needs of reared hybrid according to their age. Therefore, mixtures differed in composition (nutrient ratio), while dietary phases differed in duration: the first mixture for layers was used in the period from 18 to 45 weeks of age (for 28 weeks), the second from 45 to 65 weeks of age (for 20 weeks) and the third mixture was used from the 65th week until the end of the production cycle (in the last 9 weeks).

Farms I and IV had their own feed mixers, while farms II and III purchased complete mixtures on the market. Farm IV provided the necessary components exclusively on the market, while farm I produced some components. Only a small part of corn and soybean production on farm I was organized on its own land, while most of it was organized on rented, state-owned agricultural land by exercising preemptive lease rights due to egg production. Prices of purchased individual components or complete mixtures used in layers diet were obtained using the average annual purchase prices of agricultural products and the average prices of leading fodder factories on the domestic market for the observed period. The lease price of land in the observed period was calculated as

the average lease price per hectare of state-owned agricultural land in the district where farm I, which organized crop production in order to provide part of the feed for layers, was located. The prices of feed components produced by farm I were calculated on the basis of applied production technology and realized variable costs. The corresponding part of fixed costs in crop production was included in the egg production costs since the complete volume of corn and soybean production was used as feed for layers. Input prices in crop production (seeds, fertilizers, pesticides etc.) were calculated as the average realized in the observed period using specialized government databases.

c) Other costs – This group of costs was calculated based on each farm documentation in the observed period and it consisted of costs concerning energy, water, printing and labeling materials, control of layers health and egg quality, medications, nutritional and medical supplements, disinfection, disinsection and deratization, etc.

d) Labor cost – Within the calculation of labor costs, the minimum gross wages were used when it came to employees with lower educational levels, and the average gross wages for this type of agricultural production when it came to employees with higher educational levels, all based on official government publications and databases.

e) Housing cost – This category of costs included depreciation costs, interest costs and maintenance costs for poultry houses, other facilities and installed equipment and was calculated using farm documentation for the period of flock production.

f) General costs – The group of general costs was also calculated relying on farm records for the observed period, and it consisted of insurance costs, costs of uniforms and protective equipment, costs of bookkeeping services (if realized externally), business audit costs, costs of professional training for workers (symposia, seminars, etc.), costs of computer equipment and software maintenance, etc.

2. Sale costs include two cost categories.

a) Packaging costs – The calculation of packaging costs included only the transport packaging costs, and was obtained by multiplying the number of transport boxes and other packaging materials with their average market prices. The retail packaging costs are charged within the price of eggs, and were reimbursed when sold to customers, while packaging costs related to printing and labeling materials were already calculated within the category of other costs.

b) Distribution costs – Egg distribution costs were calculated based on farm records for the flock production period. The distribution included order processing, product handling from the farm's storage to the place of delivery and transport costs, mainly fuel, oil, tolls, registration, insurance etc.

After formulating the models, an economic analysis of farm business was performed. In order to establish the success of the observed farms, the value of production and total costs were determined. The gross financial result was calculated as the difference between the previous two.

The indicators of business success in the different housing systems and organizational conditions were established before and after mandatory transition to alternative housing systems and other organizational changes.

Finally, a comparative analysis was used to establish and interpret the difference in the indicators of business efficiency of the observed farm models, both realized before and after mandatory transition and anticipated, changed conditions. In addition, the comparison of the achieved results was performed to provide alternatives concerning decision making and possible directions in the future development of the production of table eggs.

Results and discussion

Production value, costs and financial result analysis

The amount, share and occurrence of certain cost categories were determined by numerous, mainly organizational factors, which indicated the need to analyze the structure of total costs on the observed farms (Table 1).

Table 1. The structure of total costs in the period of flock production on the observed farms

Cost category	Farm I		Farm II		Farm III		Farm IV	
	000 RSD	%	000 RSD	%	000 RSD	%	000 RSD	%
I Production costs	237,210.5	87.2	175,788.2	84.0	72,383.9	85.3	65,168.8	89.1
- Pullet cost	56,927.2	20.9	39,532.8	18.9	16,147.2	19.0	14,875.8	20.3
- Feed cost	106,779.6	39.3	93,915.1	44.9	39,317.6	46.3	36,482.4	49.9
- Other costs	23,185.1	8.5	10,284.1	4.9	2,982.4	3.5	2,119.5	2.9
- Labor cost	13,816.8	5.1	10,984.5	5.2	4,035.0	4.8	4,639.8	6.3
- Housing cost	24,909.4	9.1	14,031.4	6.7	8,312.9	9.8	5,689.4	7.8
- General costs	11,592.4	4.3	7,040.3	3.4	1,588.8	1.9	1,361.9	1.9
II Sale costs	34,770.3	12.8	33,364.4	16.0	12,522.4	14.7	7,971.5	10.9
- Packaging costs	12,900.4	4.8	9,199.3	4.4	3,652.2	4.3	3,147.8	4.3
- Distribution costs	21,869.9	8.0	24,165.1	11.6	8,870.2	10.4	4,823.7	6.6
III Total cost (I+II)	271,980.8	100.0	209,152.6	100.0	84,906.3	100.0	73,140.3	100.0

*Source: A*uthors' calculations

At the beginning of each production cycle, pullet costs must appear in the production of table eggs. Judging by their share in the total costs, they usually come in the second place, right after the feed costs. According to Van Horne (2014), the average share of pullet costs in total production costs was 19.2% in the EU in 2013. Based on the results obtained on the observed farms in Serbia, the share of pullet costs in the total costs does not vary significantly from the EU average and ranges from 18.9% to 20.9%.

Within the total costs of egg production, feed costs take the largest share. Feed costs realized during the production cycle on the observed farms were in line with the farm

capacity, i.e. they were the highest on farm I, with the largest number of layers, and the lowest on farm IV, with the smallest number of layers. However, observed per capacity unit, the situation is significantly different. Farm I had the lowest feed costs per housed hen, amounting to 852.2 RSD, while the amount of these costs on farms II, III and IV was 1,102.3 RSD, 1,129.8 RSD and 1,117.7 RSD, respectively.

The main advantage of farm I, in terms of realized feed costs, comes not only from a fully automated feeding process, but also from the fact that it organizes crop production to ensure part of the components for layers diet. The decision to produce only corn and soybeans on the total cultivated areas on farm I was based on the fact that corn and soybean semolina participate with about 75% in each of the three mixtures used as a feed for layers. The processing of soybeans into soybean semolina was performed within the farm's feed mixer. By extruding 100 kilograms of soybeans, an average of 98 kilograms of soybean semolina could be obtained, and losses of 2% in the extrusion process increased the cost price of soybean by 0.4 RSD per kilogram. During the period of flock production, 48.2% of the total required quantities of corn and 51.5% of the total required quantities of soybean semolina were provided by farm I, through its own production, while achieving savings in total feed costs compared to other observed farms.

When it comes to layers' nutrition, in addition to the composition of feed mixtures and the prices of components, according to Matthews and Sumner (2015), the total feed costs oscillate due to variations in the amount of feed per bird and the average egg production per bird over the life of a flock, as in the feed waste in different housing systems. The conversion ratio has slowly improved over the past few decades, largely as a result of the efforts of poultry breeders, which comprise a separate industry from the table egg industry, and individual producers can improve the conversion ratio through management techniques, but for the most part, they cannot influence it significantly in the short-run (Sumner et al., 2008). On the other hand, feed waste belongs more to the scope of egg producers, since it primarily results from the feeding process organization and automation level. Accordingly, even though Farm IV had made savings by making mixtures in its own feed mixer, the way the feeding process was organized had contributed to the farm being ranked second in terms of realized feed costs per housed hen.

The amount of other costs on the observed farms depends on many factors such as farm capacity, water supply (wells or city water supply), number of poultry houses and other facilities, leased and owned agricultural land, etc. During the production cycle, the highest amount of other costs was noted on farm I, primarily due to land lease costs. Their share in other costs was quite significant, about 46%, given that only this farm organizes crop production to provide part of the feed for layers and that it is organized mostly on leased land.

There are numerous factors affecting labor costs, but the most influential factors determining the required number of employees are farm capacity, the organization of the production process and the level of automation. On the other hand, in addition to the

required number of employees, the amount of labor costs is determined by employee's qualifications and price per working hour.

According to Caspari et al. (2010), in the EU, the average share of labor costs in total costs for 2008 was 4.7%. Results obtained on the observed farms in Serbia showed that labor costs ranged between 4.8% and 6.3% and did not decrease proportionally to farm capacity, mainly due to employee qualification structure and the degree of automation of the production process. Consequently, the labor costs on farm IV, which has a lower capacity, but engages more manual work, were higher compared to farm III.

Housing costs are affected by the value of fixed assets at the beginning and end of their use, length of the period of use, applied depreciation rates, the share of own and borrowed funds in total funds, interest rates, the frequency of equipment failures, and the price of spare parts, etc. Therefore, farms I and III, with enriched cages and newer equipment and facilities, had significantly higher housing costs per housed hen (203.0 and 238.9 RSD) compared to farms II and IV, with conventional cages (164.7 and 174.3 RSD).

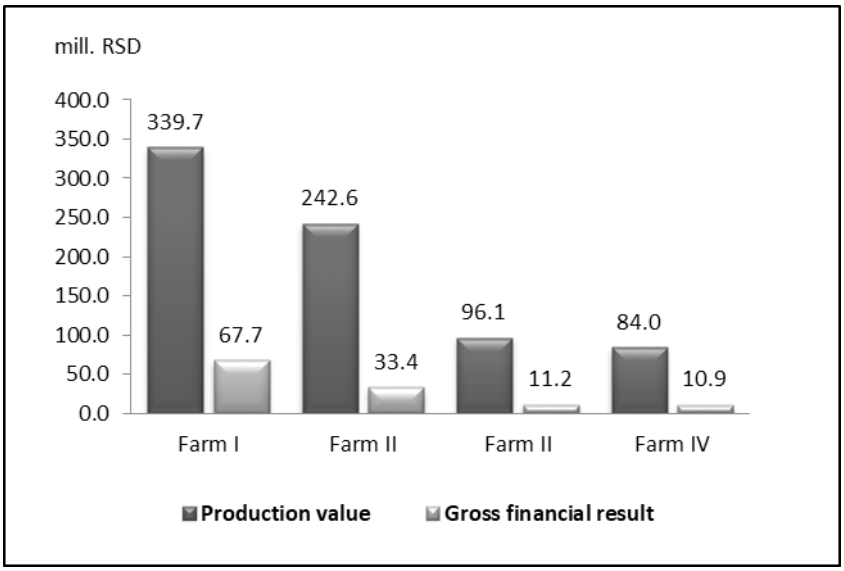
The share of general costs in total costs on the observed farms ranged from 1.9% on smaller capacity farms to 4.3% on the farm with the largest capacity. The amount of this cost category was mostly determined by insurance costs, as well as auditing costs that occur on farms that are legally obliged to perform annual audits.

Results obtained on the observed farms showed that realized sale costs range from about 8 million RSD on the farm with the lowest capacity up to 34.8 million RSD on the farm with the largest capacity. However, observed per capacity unit, the burden of sale costs was the highest on farm II, reaching 391.6 RSD, followed by farm III, I and IV with 359.8, 283.4, and 244.2 RSD per housed hen, respectively.

Significantly higher sale costs on farms II and III were realized due to high distribution costs since these farms have a large distribution network that extends throughout the entire territory of Serbia. In addition, delivery made by these farms was done, for the most part, directly to retail stores, even to large retail chains. On the other hand, regarding distribution costs on farm I, some savings were made, given that eggs were delivered to larger customers to central warehouses, while the lowest amount of these costs was realized on farm IV as a result of a relatively modest distribution network, extended mainly on the local market.

As previously mentioned, production value was calculated as the total volume of produced eggs and hens excluded from production sold at average market prices, and on the observed farms it ranged between 84.0 and 339.7 million RSD (Figure 1).

Figure 1. Realized production value and gross financial result in the period of flock production on the observed farms



*Source: A*uthors' calculations

Observed per capacity unit, the highest gross financial result (gross profit) was achieved on farm I in the amount of 551.7 RSD, while farms II, III and IV realized 392.8, 321.7 and 333.8 RSD per housed hen, respectively. Based on achieved results, farm I was significantly ahead of other observed farms, as it was the only farm that organized crop production in order to provide part of the feed for layers and accomplished considerable savings in feed costs.

Economic efficiency indicators

To establish the business success of the observed farms for the production of table eggs, the basic indicators of economic efficiency were calculated and presented in Table 2, namely cost-effectiveness (production value/total costs), profitability (gross profit/ production value) and productivity (gross profit/labor cost).

Table 2. Economic efficiency indicators on the observed farms

Indicator	Farm			
	I	II	III	IV
Cost-effectiveness	1.25	1.16	1.13	1.15
Profitability	19.93	13.79	11.65	12.96
Productivity	24.58	22.09	23.82	18.11

*Source: A*uthors' calculations

The calculated indicators of economic efficiency on all observed farms showed that egg production was cost-effective and profitable with a satisfactory productivity level. Judging by all the economic efficiency indicators, the best results were achieved on

farm I. The slightly lower value of these indicators was realized on farms with lower capacity due to considerable investments in new equipment on farm III and semi-automation of the production process on farm IV.

Since the law in Serbia forbids rearing layers in conventional cages since 2020, the calculation of costs incurred by transferring to an enriched cage system has been performed on farms II and IV.

The increase in total production costs given in Table 3 represents the difference between newly incurred liabilities, based on credit funds raised for new equipment, and savings made in labor costs, based on full production process automation.

Table 3. An increase in total costs of the production cycle on farms II and IV due to the transition to an enriched cage system (000 RSD)

Category	Farm	
	II	IV
Newly incurred loan repayment costs	11,061.8	5276.4
Decrease in labor costs	-	1,558.0
Increase in total production costs	11,061.8	3,718.4

*Source: A*uthors' calculations

Farm II had a fully automated production process, even before the transition to an enriched cage system, so the savings in labor costs were calculated only for farm IV. Therefore, the transition to an enriched cage system caused an increase in total production costs between 5.1 and 5.3% on these farms.

Also, farmers face numerous difficulties related to the possibility of organizing their crop production to obtain part of the components for making complete mixtures, as well as the possibility of building their capacities for feed processing.

Possibilities of reducing production costs through organizing crop production are limited due to the availability of land resources, changes in legislation related to the right of the pre-emption of state-owned agricultural land and farm's ability to meet the application requirements, prospects for providing mechanization and other necessary resources for crop production, etc. Hence, if there were no opportunities for the production and processing of some mixture components, this would inevitably lead to an increase in feed costs on farms I and IV (Table 4).

Table 4. An increase in feed costs in the production cycle on farms I and IV due to the purchase of complete mixtures on the market (000 RSD)

Category	Farm	
	I	IV
Feed costs – own production of some components and/or processing	106,779.6	36,482.4
Feed costs – purchase on the market	133,208.5	38,160.6
Increase in feed costs	26,428.9	1,678.2

*Source: A*uthors' calculations

Based on the data from Table 4, it can be noted that there would be an increase in feed costs if there were no organizational conditions enabling the production and processing part of the components for layers' nutrition. Feed costs would be higher by 1.68 million RSD on farm IV and 26.43 million RSD on farm I, although an increase in total production costs on farm I would be 15.78 million because of the reduction in other costs by 10.65 million RSD, which is the amount that farm pays for the leased land. Therefore, an increase in feed costs would lead to an increase in total costs ranging between 2.3 and 5.8%.

The transition to an enriched cage system and the purchase of complete feed mixtures on the market would have a negative impact on most economic efficiency indictors of the observed egg farms (Table 5).

Table 5. Economic efficiency indicators on the observed farms after the transition to an enriched cage system and the purchase of complete mixtures on the market

Indicator	Farm			
	I	II	III	IV
Cost-effectiveness	1.18	1.10	1.13	1.07
Profitability	15.28	9.23	11.65	6.54
Productivity	24.58	22.09	23.82	27.27

Source: Authors' calculations

The comparative analysis points to the fact that the only increase could be expected in productivity on farm IV due to reduced labor costs, while all other indicators would decrease or, at best, remain unchanged. Most of the calculated business performance indicators reached the highest values on farm I, even with a reduction ranging from 5.6 to 23.3%.

Farms II and IV, with conventional cages, would endure the strongest negative effects of anticipated changes. On farm II, the reduction of economic efficiency indicators would range from 5.2 to 33.1%, while the strongest impact would occur on farm IV whose profitability would be almost halved, reduced by 49.5%. On the other hand, farm IV would endure significant productivity elevation, by about 50%.

By comparing obtained results, it can be concluded that the producers' concern about the transition to an enriched housing system was completely justified. This transition represents a certain "de-intensification" of table egg production followed by increased costs due to the purchase and installation of new equipment, and in some cases, the reconstruction of existing or building new poultry houses. Also, the absence of organizational conditions to produce and process feed components on their farms would limit producers' alternatives for cost management.

Conclusions

Changes in organizational conditions have a considerable effect on egg production total costs and, consequently egg producers' business performances. Some of these changes are uncontrollable and lawfully mandatory, while others are within the producer's scope.

The results of the conducted study confirmed both assumptions made about the impact of the housing system, the way of providing feed for layers and the level of automation of the production process on the business efficiency of the observed farms.

When it comes to the ban on conventional cages, study results showed that the transition to enriched cages had the strongest impact on profitability, which endured a reduction almost by half on the farm with the semi-automated production process. The transition from semi-automation to full automation of the production process was twofold regarding costs. It caused an increase in costs due to the investments in new equipment, and a reduction in labor costs due to fewer employees. However, as full automation required a much larger investment than labor cost savings, such a change had an adverse effect on total production costs.

Therefore, it can be concluded that the transition to an enriched cage system inflected economic efficiency indicators negatively, which was most noticeable in the farm's profitability and accumulative capacity. Additionally, the economic motivation of a large part of producers who had old technical solutions within conventional cage systems was questioned by the reduction of financial results due to this mandatory transfer.

Obtained results also showed that the possibility to produce and process part of feed components for layers allowed farms to make some savings in feed costs. For egg producers, a lack of opportunities to organize crop production and/or build capacities for its processing would mean an increase in total costs between 2.3 and 5.8%, which would further lead to a deterioration of economic efficiency indicators.

That is why egg producers should consider options to improve business performance through organizing crop production and building their feed mixers whenever organizational conditions allow it. Also, obtained results may be used as a foundation for further research to measure and assess the economic efficiency of investments in land purchase to organize the production of main components for layer nutrition.

Conflict of interests

The authors declare no conflict of interest.

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GASTRONOMY OFFER IN A FUNCTION OF CREATION AND CO-CREATION OF A RECOGNIZED HOTEL BRAND - ILLUSTRATIONS FROM HOTEL CRNI VRH

Tamara Gajić[1], Miloš Zrnić[2], Tamara Vujić[3], Milan Vujić[4], Đorđe Stojanović [5]

**Corresponding author E-mail: milos.zrnic@vhs.edu.rs*

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ABSTRACT

The aim of the paper is to point out the possibility of the influence of the quality of the gastronomic offer in the restaurant of the hotel Crni vrh, on the creation or co-creation of the hotel brand. The quality items of the hotel's complete catering offer were analyzed and grouped by exploratory factor analysis into three factors (Food, Space and Personality). The results of the multiple regression analysis determined the contribution of two quality factors to the creation of the hotel brand. Also, the research came to the conclusion that the majority of visitors, after the experience gained, decide to come again to the rural and mountainous areas, and a smaller percentage to the urban environment. The importance of the research is reflected in the contribution of the existing literature, in the contribution to future more important research, as well as in finding strategic solutions for better hotel operations.

Introduction

The entire restaurateur's offer depends to a large extent on the quality of the food offered in the restaurant's offer (Namkung & Jang, 2007). There is little research in the world that gives results related to the influence of other factors such as design,

1 Tamara Gajić, PhD, Geographical Institute "Jovan Cvijić" SASA, Đure Jakšića 9, 11000 Belgrade, Serbia. South Ural State University, Institute of Sports, Tourism and Service, Chelyabinsk, Russia. Faculty of Hotel and Tourism Management, University of Kragujevac, Vrnjačka Banja. E-mail: tamara.gajic.1977@gmail.com, ORCID ID (https://orcid.org/0000-0003-3016-8368)

2 Miloš Zrnić, MSc, Lecturer at the Academy of Applied Studies – The College of Hotel Management, Kneza Višeslava 70, Belgrade, Serbia. E-mail: milos.zrnic@vhs.edu.rs, ORCID ID (https://orcid.org/0000-0003-3454-6573)

3 Tamara Vujić, MSc, Lecturer at the Academy of Applied Studies – The College of Hotel Management, Kneza Višeslava 70, Belgrade, Serbia, Phone: +381692272059, E-mail: tamara.vujić@vhs.edu.rs, ORCID ID (https://orcid.org/0000-0003-3454-6573)

4 Milan Vujić, MSc, Lecturer at the Academy of Applied Studies – The College of Hotel Management, Kneza Višeslava 70, Belgrade, Serbia. E-mail: milan.vujic@vhs.edu.rs, ORCID ID (https://orcid.org/0000-0002-5870-0224)

5 Đorđe Stojanović, PhD, Lecturer at the Academy of Applied Studies – The College of Hotel Management, Kneza Višeslava 70, Belgrade, Serbia. E-mail: djordje.stojanovic@vhs.edu.rs. ORCID ID (https://orcid.org/0000-0001-9771-3389)

interior, exterior, employees, on the influence of restaurant business quality and brand creation. All recent researches mainly study the quality of the gastronomic offer, and consider it crucial for the survival of restaurants or hotels, and even destinations on the tourist market and the service market (Gajić et al., 2022). Modern business and lifestyle give increasing importance to traditional gastronomy, visits to rural and mountain areas (Medić et al., 2015). The gastronomic offer in the restaurants of such destinations allows consumers to become more thoroughly acquainted with the everyday culture and life, the traditions of the people, and to get to know the true values and spirit of the destination (Gajić et al., 2022). The experience in destinations and restaurants, where tourists can feel the spirit of history and culture, as well as traditional ones, affects their perception of the entire offer, and therefore the possibility of creating a brand, or co-creating an already existing brand (Aaker et al., 1994). Nowadays, apart from the fact that gastronomy is an integral part of the tourist destination and the tourist experience, it is also considered to be a form of art, as well as an inspiration for hobbies and entertainment (Baldwin et al., 2011). If we look at the concept of gastronomy realistically, it can be seen that this statement is correct. Through the creation of different gastronomic products, there is a need for constant improvement of the same products, beautification, work on visual and other sensory factors (Gajić et al., 2022; Pantić et al., 2021; Zrnić et al., 2021). The gastronomy of Serbia is a combination of different cultures and traditions, but it can certainly be said that despite the weak spectrum of typical traditional food, there is the possibility of preparing every dish on offer in a traditional way (Medić et al., 2015; Luković et al., 2022). Serbian cuisine has changed its characteristics for centuries depending on the different cultures and civilizations that came to these areas (Bekar & Gövce, 2019). Food can certainly be a specific representative of a destination, and influence the creation of a brand, both new and changing the existing brand in the minds of consumers (Chen & Chen., 2014). No matter how much Serbian food has undergone changes over the centuries, every user who stays in a hotel in one of the Serbian mountains or in rural areas, thinks that he is trying typical traditional Serbian food (Gajić et al., 2022). The goal of every restaurateur would be to adapt the gastronomic offer to the tradition and culture of the people, at least by preparing it in a specific way (Gilbert et al., 2004).

The goal of the research was to see the state of quality of the entire restaurant and gastronomic offer at the Crni vrh hotel on the Divčibare mountain, and based on that, to establish whether the users think that the quality offers can justify the brand that is marketed for this destination, or to create a new brand on the market. Tourist destinations support the development of quality traditional gastronomy, and consider the gastronomic offer a tourist resource, which will bring the destination to a high level on the tourist market of supply and demand. At the beginning of the research itself, two research questions were asked, which should receive an answer with the confirmation of the initial hypotheses: Can the experience they gained based on the gastronomic offer in the restaurant of the hotel Crni vrh, be a factor in creating a new brand and co-creating an existing brand in positive direction? Will tourists, because of the experience

gained in the restaurateur and gastronomic offer in the hotel, opt for the traditional gastronomy of villages and mountain destinations, or the offer of urban areas?

The importance of the research is primarily reflected in determining the quality of the existing gastronomic offer of the hotel Crni vrh. Considering that there is a very small amount of literature related to the quality of restaurant business of this hotel, the results can contribute to the importance in the theoretical and applied sense. Based on the results, it will be possible to see the current situation and devise strategic measures for corrective activities in order to improve the quality of the offer, thus creating a positive awareness among consumers and a positive impact on brand creation. Also, the results can serve for larger research on the given problem, and contribute to the literature, which is very scarce.

Background of the Study Area

The importance of a quality gastronomic offer in restaurants on the creation of a brand

The creation of an authentic brand in gastronomy is related to the acquired experience of tourists at the destination itself or in the restaurant (Ha & Jang., 2010). Gastronomy helps to create a unique impression of a tourist destination. The post-industrial era has created specific consumers, who are increasingly striving to evaluate the sensory factors of food, thereby evaluating the gastronomic offer and creating an authentic brand (Zrnić et al., 2021). Tourists are more demanding and want, in addition to the basic offer in the form of food, to receive the entire service, on the basis of which they will get to know the official culture, recognized works of art and tourist attractions, but also to have a deeper understanding of the destination, the daily life of the inhabitants and local traditions (Yi & Choi, 2012). A strong brand symbolizes not only the type of service that will be provided to the consumer, but also the type of experience that they will experience on that occasion (Woodside et al., 2009). In general, the brand is a guarantee of quality, thus increasing consumer confidence that their expectations will be met, or even exceeded (Gordin et al., 2016).

The first forms of providing food and beverage services in order to create a specific and recognizable destination, and then to generate profit, date back to the period of ancient civilizations, while the first commercial restaurants appeared much later (Šerić & Gil-Saura, 2012). Taverns in Serbian society are given the importance of an institution that has multiple functions: economic, social, cultural, political, democratic, information-communication, stage and theater, driving, and even the function of a battlefield for gender equality (Rakić & Rakić, 2010; Radović & Keković, 2014). Despite the fact that the first restaurateurs were focused on offering drinks, Serbian restaurants put food in the foreground, which is in line with the existence of a food cult (Rakić & Rakić, 2010). Restaurants that operate within the hotel, as well as those outside of that operation, create a product that is a combination of material elements and interconnected service activities (Rather & Sharma, 2016). All these elements are included in the restaurant product, which can be further broken down according to the needs of the guests, in order to satisfy their demands, and to create a brand

recognizable by consumers (Konuk, 2019). According to Chen & Chen (2014) restaurant product includes the following elements: physical product (food and beverage), service environment, quality of service delivered, location and price (Ii & Choi, 2012). The same authors claim that with the help of the quality of all the mentioned factors, it is possible to create brand or co-create an existing brand on the market.

Many researchers and theoreticians believe that in the modern period, the gastronomic offer must be adapted to new tendencies, in order to create a recognizable brand (Zrnić et al., 2021). The traditional offer is considered more acceptable for consumers, especially if we are talking about food served in restaurants in rural areas or mountain destinations (Gajić et al.,2022). Such food is considered by consumers as local food, which is desirable as a primary factor in attracting tourists, and creating a brand that will bring the same tourists back to the given destination (Gajić et al., 2022). With a quality gastronomic offer, it is possible to form the local authenticity of all the products on offer, and to create a specific image of the given destination in the mind of the consumer, in the form of its attractiveness and a special brand (Aaker et al., 1994). With a traditional or local offer, tourists feel the place and the spirit of the place and the people of that destination (Jang & Ha, 2015).

Even some researches have indicated different factors of the quality of the offer of certain restaurants that affect the satisfaction of the specific demands of the guests (Dion & Arnould, 2016). Some authors point out that these are usually factors such as the quality of the food, the quality of the overall service and the pleasant atmosphere (Nam et al., 2011; Pavlović et al., 2021; Manhas & Tukamushaba, 2015; Šerić & Gil-Saura, 2012; Šapić et al., 2019). In particular, all the mentioned factors are part of a quality gastronomic offer in restaurants, but also the main implicators for the development of a specific brand or the co-creation of an existing brand (Baldwin et al., 2011). The repeated return of consumers is conditioned by a quality gastronomic offer, their satisfaction with food, but also other factors that make up an overall positive experience for consumers (Kim et al., 2013). In addition to the impact on satisfaction and restaurant choice, Anselmsson et al (2014). found that food quality also affects the brand image in consumer perception (Zrnić et al., 2021). The quality and popularity of restaurants and other catering facilities is based on the variety of dishes. In this way, existing guests are retained and new guests are attracted (Chen & Chen, 2014). The restaurateur preserves tradition and acquires an image in the form of recognition for the content and quality of the gastronomic offer (Yi & Choi, 2012). Guests choose from alternative fast service facilities based on attributes such as location convenience, price, consistency, food quality, service quality and cleanliness (Mun et al., 2022). Guests "selective perception, selective distortion and selective retention" determine which attributes are perceived as important for their needs and become part of a lasting brand image (Nicolaides, 2018). The main goal of the restaurant, but also of every other company, is satisfaction and value creation, which is of special importance for conquering the market. That is why creating "value and consumer satisfaction" is the heart of modern marketing thoughts and practices (Erkmen, 2019).

There are more and more tourists who are looking for an authentic experience, and visit local restaurants and regularly consume local food, and in this way feel the tradition, the culture, the way of life of the people from those areas (Lu et al., 2015). Serving food and drinks is a complex process, composed of a number of factors that, if they are of high quality, can influence the consumer's perception of both the gastronomic offer and the destination (Ismail et al., 2016).

According to the study of the existing literature on the topic of the influence of the quality gastronomic offer of the restaurant, the authors set initial hypotheses:

H1: The quality of the gastronomic offer, as well as the entire restaurant offer of the hotel Crni Vrh, is at relatively satisfactory level

H2: Factors of the quality of the gastronomic offer can influence the creation and co-creation of the existing Crni vrh hotel brand

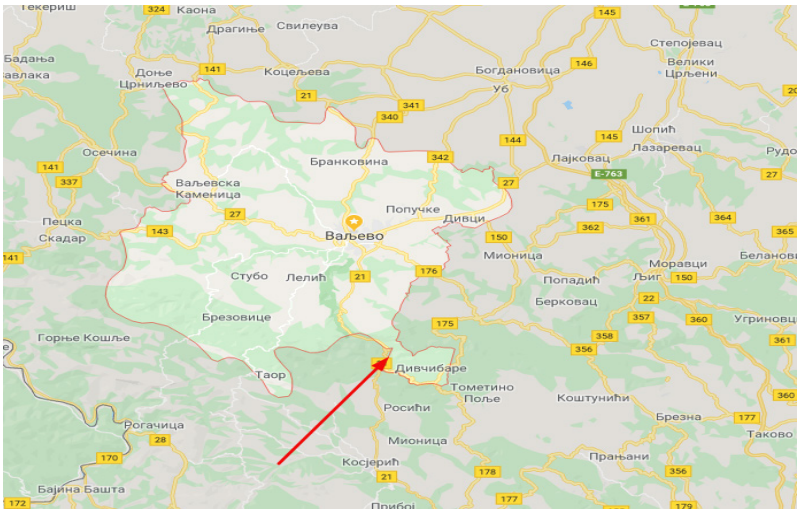
H3: Tourists, after experiencing the gastronomy of the destination, will rather visit the rural and mountain fart than the urban environment.

Methods

Area of research and sample

Qualitative research was carried out, based on available literature, and quantitative based on data collected by field research, as part of a pilot volunteer research. In the period from January to July 2022, the authors surveyed 352 respondents in the restaurant of the Crni vrh hotel on the Divčibare mountain in Serbia. The hotel is located at an altitude of 980 meters and is 118 km from Belgrade. It is categorized with four stars, and has a total of 111 rooms for accommodation and one restaurant for catering to visitors.

Figure 1. The position of the hotel Crni Vrh on the Divčibare mountain



Source: https://www.google.com/search

Over 500 questionnaires were distributed, but a total of 352 were collected with complete answers that can be taken into consideration and further analysis. The required number of respondents according to the G*power test is 119. Considering that there were a total of 3 predictors (19 items) and 1 criterion, the required effect size was set at $\eta 2 = 0.15$, with statistical power of 0.95, and it was calculated that a sample size of 119 respondents could be appropriate for this research. Which means that the total number of respondents that the authors managed to collect is considered representative. However, it must be noted that the research is a pilot and volunteer research. Of the total number of respondents, 46.9% were female, while 53.1% were male. A total of 32.6% belonged to the age group of 20 to 35 years, followed by 40.5% from 36 to 55 years, and 26.9% over 56 years of age. There were a total of 28.9% of tourists or research participants with an average monthly income of less than 500 euros, followed by 42.3% with an income of 500-1,000 euros, and 28.8% with more than 1,000 euros. As for the educational structure of the respondents, 35% of them belong to the group with completed high school, 28.3% with higher vocational school, and 36.7% with university education. Of the total number of respondents, 25% come from Vojvodina, followed by 36.7% from the region of Belgrade and Central Serbia, and 30% from Western Serbia and only 8.3% from Southern Serbia.

Measures

The authors used a modified version of the questionnaire for determining the quality factors established by the author Ali Solunoglu, in his research entitled Perceived Food Quality, Satisfaction, Brand Image In Restaurants And Recommendation Intention Relation (2020). Cronbach's alpha values are given for each of the factors. More precisely, the coefficient is used to measure the reliability of each item or scale given. Values are given in parentheses for each of them, and It can be seen that the reliability of each factor in this research is with high value. Three factors were established with the following items: Factor 1 – Food (Quality food, Fresh food, Sensory preferences (smell, taste, visual appearance of food), HACCP standards are followed, Homemade food, Homemade drinks, The traditional way of preparing food, Mark of origin on the product, Local domestic products available in restaurant, Preparing food on the spot,α=0,832), Factor 2 – Space (Specific exterior and interior, Hygiene at the satisfactory level, Availability of information, good signalization; α=0,769) and Factor 3 - Personality (Assistance to tourists is always available from the service provider, Every guest is treated individually, Service providers do their job correctly, Service providers provide all information, Service providers know foreign languages; α=0,817). The criterion Creating/Co-creating Brand contains four variables with their reliability values: The quality of the complete tourist offer can create a brand (α=0,720), Price influences brand creation (α=0,802), A gastronomic offer can create a brand (α=0,790), Marketing can influence brand creation (α=0,815).

Data analysis

Respondents expressed their views on five-point Likert scales. The respondents evaluate the stated findings on a scale from 1 to 5, where 1 means "absolute dissatisfaction", 2-"dissatisfaction", 3-"dont have opinion", 4 -"satisfaction", "while 5 means "absolute satisfaction". Data analysis was performed using the statistical program IBM SPSS (Statistical Package for the Social Sciences SPSS 22). Parametric statistics were used to analyze the results, as it was established that the distribution of the data is normal. Values of Skewness and Kurtosis (Sk and Ku) are in the range -1.5 – 1.5 (according to o Tabacnick and Fidell (2013). A descriptive statistical analysis was performed in order to determine the value of each of the items, and in order to negate one of the initial hypotheses, which concerns the achieved quality of the gastronomic offer in the restaurant of the hotel Crni vrh. After that, the authors performed an exploratory factor analysis, in order to group the items into a certain number of factors, and determine the percentage of variance explained, as well as the percentage of saturation for each factor. Factor analysis determines group membership for each item, where all variables in one group are highly correlated with each other, but are weakly correlated with variables in other groups. Multiple regression analysis confirmed the influence of factors on brand creation or co-creation. This analysis is used when there is a determination of the influence of one dependent and several independent variables. Using binary logistic regression, the authors tried to determine to what extent the respondents, after the experience gained, decide to visit the rural and mountainous area again, or decide to stay in the city.

Results

Research design included the following steps: identifying the problem, setting research questions, determining the model with goal setting and hypotheses, determining the sample, collecting data through field research and available literature, analyzing and processing data, making concluding remarks. Table 1. provides an overview of the average ratings and standard deviation values for each item that is grouped into one of the three listed factors.

Table 1. Descriptive values for quality items

	m	sd
All safety standards of the space have been achieved	3.15	.871
Quality food	4.44	.771
Fresh food	3.87	.815
Sensory preferences (smell, taste, visual appearance of food)	3.67	.777
HACCP standards are followed	3.31	.601
Homemade food	2.45	.753
Homemade drinks	2.87	.794
The traditional way of preparing food	3.46	.776
Mark of origin on the product	2.07	.329
Local domestic products available in restaurant	2.33	.630

	m	sd
Preparing food on the spot	3.34	.570
Specific exterior and interior	3.57	.778
Hygiene at the satisfactory level	4.06	.910
Availability of information, good signalization	3.62	.782
Assistance to tourists is always available from the service provider	3.20	.886
Every guest is treated individually	3.85	.852
Service providers do their job correctly	2.71	.895
Service providers provide all information	3.78	.746
Service providers know foreign languages	3.77	.906
The quality of the complete tourist offer can create a brand	4.08	.915
Price influences brand creation	3.60	.820
A gastronomic offer can create a brand	3.85	.740
Marketing can influence brand creation	4.05	.683
FOOD	3.16	.560
SPACE	3.75	.830
PERSONALITY	3.46	.790
CREATING/CO-CREATING BRAND	3.89	.850

Source: author`s research. *m – arithmetic means, sd- standard deviation

A total of 19 items representing the quality factors of the gastronomic service, which were evaluated by the respondents in the restaurant of the hotel Crni vrh, were included. It can be seen that the item Quality food, which belongs to Factor 1-Food, has the highest average rating (m=4.44, sd=0.771). The item Mark of origin on the product has the lowest average rating from this group of factors, with an arithmetic value of 2.07. Regarding Factor 2 - Space, the item Hygiene at the satisfactory level (m=4.06) received the highest rating, and the item Specific exterior and interior (m=3.57) received the lowest rating. In Factor 3 – Personality, the item Every guest is treated individually (m=3.85), and the item Service providers do their job correctly (m=2.71) has the lowest score. Given that a five-point Likert scale was used (table 1), and the average scores obtained for each item above 3, approximately the descriptive value of "satisfaction" on the given scale, and that the factors are also with an average score slightly above 3, it can be considered that visitors are relatively satisfied with the service at the hotel. We can say that the initial hypothesis H 1 has been confirmed, that the quality of the service is at a relatively satisfactory level.

Exploratory factor analysis determined the existence of exactly three factors out of all 19 grouped items. The first factor shows the highest saturation percentage of 27.1%, while the last one shows the lowest percentage. A total of 57.2% of the variance was explained, as can be seen from the data in Table 2.

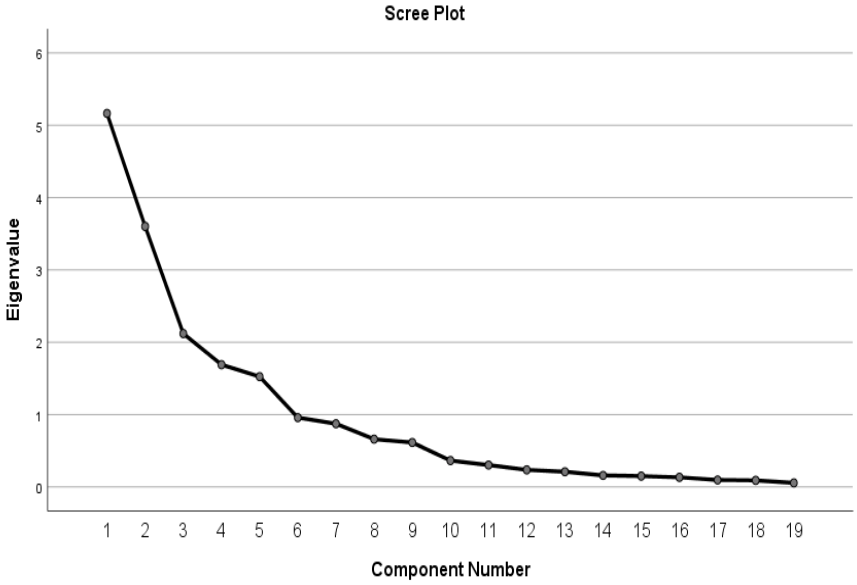
Table 2. Results of exploratory factor analysis
(number of factors and percentage of saturation)

		Initial Eigenvalues		Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
Food	5.164	27.179	27.179	5.164	27.179	27.179	4.928
Space	3.602	18.956	46.135	3.602	18.956	46.135	3.377
Personality	2.120	11.157	57.292	2.120	11.157	57.292	2.400

Source: author`s research

Also, observing the scree plot, exactly three factors were established. Figure 2. gives an insight into the scree plot model, exploratory factor analysis. The inflection point of the curve is observed exactly at the third factor. It is a plot of eigenvalues and factor number according to the order of extraction. This plot is used to determine the optimal number of factors to be retained in the final solution.

Figure 2. Display of the number of factors according to the scree plot model



Source: author`s research

After determining the number of factors, it is necessary to analyze the impact of all three obtained factors on the possibility of creating or co-creating a brand (values of predictors and criterion variables are given in Table 1). With this aim, a multiple regression analysis was performed.

The values obtained by multiple regression analysis show that the model is reliable, more precisely, that it fits the data well: R^2= 71.2%; F (3, 352) = 72.907 with a statistical significance value of p= 0.00. The model explains a total of 71.2% of the variance. Table 3. shows the partial contributions of each factor that has the function of a predictor for the criterion variable - brand creation.

Table 3. Results of multiple regression analysis

	Unstandardized Coefficients		**Standardized Coefficients**		
Model	B	Std. Error	Beta	t	Sig.(p)
(Constant)	0.065	0.117		0.554	0.580
Food	0.190	0.033	0.245	5.810	0.000
Space	-0.150	0.085	-0.092	-1.765	0.059
Personality	0.058	0.004	0.761	13.575	0.000

Source: author`s research. *Dependent Variable: creating or co-creating brand; Predictors: food, space, personality

Looking at the results from the table, it can be seen that two factors show a contribution in influencing the creation or co-creation of the brand, based on the quality of the gastronomic offer in the restaurant operating within the hotel Crni vrh. Only factor 2 (Space) is at the very limit of statistical significance (p=0.05), which is considered to have no influence on the criterion variable. Hypothesis H2 that quality factors can statistically significantly predict brand creation was partially confirmed. Thus, the answer to the first research question was obtained.

In order to determine the visitor's decision, whether after the experience gained on the mountain and during the stay at the hotel Crni vrh, they decide to visit the rural and mountain area again, or they still decide for the urban environment, a binary logistic regression was performed. Due to the value of the Hosmer and Lemeshow Test, it can be seen that the model can be applied. The value of p, in this type of regression must exceed 0.05, which can be seen in Table 4.

Table 4. Justification of the application of the model and results of binary logistic regression values

Step	**Chi-square**		**df**	**Sig.**
1	45.789		8	.090
village and mountain	96.2%	57.8%		
Urban destination	3.2%			
Nagelkerke R Square – 28.8%				
H3- CONFIRMED				

Source: author`s research

The Table 4. shows the Nagelkerke R Square value of 28.8%, which indicates the percentage of variance explained. A total of 96.2% of respondents decide to come back to the village or to the mountain after their stay in the hotel and experience with the

gastronomic offer in the hotel's restaurant. However, only 3.2% of respondents prefer urban areas. The percentage of correct grouping is 57.8%. Hypothesis H3 is confirmed, but the second research question is also answered.

Conclusion with limitations and future implications

The gastronomic offer has always been an indispensable part of the entire tourist offer of the destination. However, in recent decades, gastronomy has gained increasing importance as an attractor of tourists to certain destinations. The modern way of life draws more and more people towards the return to nature, traditional values and the discovery of old cultures and habits. In this context, traditional gastronomy is gaining more and more importance. Restaurateurs are aware of the fact that with a good quality gastronomic offer, they can influence the creation of satisfied and loyal consumers. Destinations like Serbia are still completely undiscovered and almost unknown to some tourists. However, in order to attract as many tourists as possible, it is necessary to create a brand or strengthen it, if it already exists. Creating or co-creating a brand in the rural or mountainous areas of Serbia is also the task of hospitality employers, and the success of marketing the gastronomic offer to the public. Aware of the specifics of preparing food in a traditional way, they are fully capable of creating a hotel or destination brand.

In accordance with the available literature, the authors of the manuscript carried out field research on the Divčibare mountain in Serbia. The survey was distributed to visitors of the restaurant that operates within the hotel Crni vrh, in the period from January to July 2022. Out of the total number of questionnaires, 352 validly completed questionnaires were collected. The G*power test model shows that 119 is a sufficient number for a representative sample, but a much larger number of valid sheets was obtained, which speaks of the achieved representativeness of the sample. Two research questions were asked, concerning the influence of the quality of the gastronomic offer on the creation and co-creation of the hotel brand, as well as whether tourists, after the experience they had, return to the village and the mountain, or prefer to go to urban areas. Also, in accordance with the research questions, three hypotheses were set.

Descriptive statistical analysis confirmed the satisfactory quality of the gastronomic and complete restaurant offer of Hotel Crni vrh. This confirmed the first starting hypothesis, that the quality is at relatively satisfactory level. Then, through exploratory factor analysis, the items were grouped into exactly three factors (food, space and personality), which was confirmed mathematically by Horn's parallel model, as well as the scree plot model. Through multiple regression analysis, the partial contribution of each factor to the possibility of creating and co-creating a hotel brand was determined, thereby partially confirming hypothesis H2. After that, the authors started determining the second research question, which is followed by hypothesis H3, and that is whether the visitors after the experience will still decide to visit the village and the mountain or whether they will still decide for the urban environment. The results show that 96.2% of respondents decided to visit the village and mountain destination again.

There were limitations during the research in a theoretical and applied sense. The lack of existing literature on this issue is one of the limiting factors. In addition, visitors' non-cooperation with interviewers was also prevalent. The fear of the pandemic and socializing without distance is still present among some visitors. Consequently, this research can be important in supplementing the existing literature, as well as being part of a wider and more significant research on the same topic. Also, noticing shortcomings in the quality of service, employers will at least be able to assume mistakes and devise strategic measures for future successful business, survival on the market and to deal with increasingly strong competition.

Conflict of interests

The authors declare no conflict of interest.

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DRY SPA AS A FACTOR OF RURAL DESTINATION DEVELOPMENT

Leposava Zečević[1], Aleksandra Vujko[2], Dragan Nedeljković[3]

**Corresponding author E-mail: aleksandravujko@yahoo.com*

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ABSTRACT

If we look at the energy as something that is all around us, then it is clear that energy as such can be used even for the purpose of tourism. Sofia's springs is the dry spa which is located in the national park and the fields with the strongest positive radiation in the world are the phenomenon. Whether this is a placebo effect or a real effect of bio energy circles, this location has the potential to attract "health tourists" from all over the world. The research took the whole 7 years, during which we analyzed motives and views of 687 foreign visitors of these springs who came to the springs by bicycles from 6 European countries. The analysis showed that the visitors believe that the dry spa helps them in solving health problems, including Covid-19, which invites medical science to examine it in detail and confirm or reject it. Anyways, that represents a backbone of health tourism development and can directly influence the rural destination development.

Introduction

Health tourism represents such a movement in which the essence of movement is in fulfilling the need for health (Oh, 2000; Conell, 2006; Reed, 2008; Conell, 2013; Chuang et al., 2014). Living in the modern world means fighting with stress and other everyday problems, so this need became fundamental, and motives based on the term "health" also became attractive and desirable (Crooks et al., 2011).

Health tourism, thus, becomes growing segment of the economy of many countries, which nurture, assert and promote health as something of great importance, which health most certainly is (Garcia-Altes, 2005; Ghosh, Mandal, 2019).

1 Leposava Zečević, Full Professor, European University, Faculty of European Business and Marketing (Vojvode Dobrnjca 15, Belgrade 11000, Serbia), Phone: +381 63 233599; E-mail: bekaz70@gmail.com, ORCID ID (https://orcid.org/0000-0002-0689-4709)

2 Aleksandra Vujko, Associate Professor, European University, Faculty of European Business and Marketing (Vojvode Dobrnjca 15, Belgrade 11000, Serbia); Phone: +381649142645, E-mail: aleksandravujko@yahoo.com, ORCID ID (https://orcid.org/0000-0001-8684-4228)

3 Dragan Nedeljković, Full Professor, European University, Faculty of European Business and Marketing (Vojvode Dobrnjca 15, Belgrade 11000, Serbia), E-mail: dragannedeljkovic62@gmail.com

The term dry spa is of a recent date. It refers to the areas where body heals, rehabilitates and manifests positive effects of spa and wellness treatments, but it is an area without water. When it comes to "Sofia's springs", they represent such a place where positive radiation is noticed, which is very beneficial for human health. Therefore, Sofia's springs are dry spa. The energy which is felt there helps curing many illnesses, as well as preventing several of them.

Whether this is a placebo effect or a real electromagnetic force, one is for sure, this place becomes more and more popular among people and they gladly return to the geosite. Having all in mind, we need to state that this is a type of health tourism which is becoming more and more present in the global market. We have been witnessing the Covid-19 virus situation which has emerged during 2021 and which still lasts. There are numerous destinations which promote their post-COVID treatments and the positive effects of these treatments on people's recovery after they have suffered this difficult illness. People cross hundreds of miles and pay a lot of money to recover and regain state they were in before the illness.

Unfortunately, many of them still feel bad after those treatments. However, this virus is just one of the many vicious diseases which humanity has faced. Health tourism, thus, becomes indispensible type of movement in three directions: healing, rehabilitation and prevention (Heung et al., 2011; Han, 2013). From these three, "prevention" is one of the most powerful tools which is at the disposal of health tourism, and the destinations classified as wellness and spa destinations, are becoming even more popular and visited. (Lu et al., 2016). Also, local inhabitants become more aware of the potential which certain geosites have and of how to use them adequately. (Vujko et al., 2021). In this regard, the authors of the paper came to the idea to conduct surveys among the visitors of the geosite Sofia's springs.

The main hypothesis of the paper is set, that this geosite, so called "dry spa", has a potential to provide development of a rural area.

Overview of the Sofia's springs

According to Oschman (2005) "healing energy" represents such energy which, if directed towards a certain problem, has "the power" to heal even the largest of the problems. It is enough to believe and keep to certain "rules". We are referring to bio radiation which influences human health if one stands for long enough in energy circle.

Elerian et al. (2021) claims that this is electricity of a specific bio structure which comes from the Earth centre and spreads out several km above its surface, thus creating an impact on human immune system and on the recovery of many diseases.

Sofia's springs are located in the national park Fruška gora in Serbia. It is located on the road Ležimir – Sviloš, which is also called "Partisan Road (Partizanski put)", near the crossroads, so the accessibility is really good. Sofia's sources still do not have a scientific foundation in medicine about benefits for health.

"Dry spa" represents the unique phenomenon in the nature (Pralong, 2005), and according to Elerian et al. (2021), such energetic phenomena are very popular destinations of health tourism nowadays. People are grasping at straws when health is at stake, and are ready to cross miles to find cure se (Wang, 2012; Pantić et al., 2021; Yu & Ko, 2012; Bogavac et al., 2021; Wongkit & McKercher, 2013). Plitvice National Park, Croatia; Lake Neusiedl, Austria; Delphi, Greece etc. are just some of the locations where 'healing energy' of magnetic field is recorded. In the paper we used modified GAM/M-GAM model, based on health component which was the initial hypothesis of the paper, as a statement that exactly this dry spa, has a potential to provide development of a rural area.

What connects our model and health tourism is 'healing energy'. Here it is the energy of the geosite Sofia's springs. According to scientists 'healing energy' (Hamer, 1968; Macklis, 1993; Ho, 1997; Lin & Hopf, 2003) is such energy which directly influences human health, by improving it and by making people more healthy thanks to enhanced immunity.

The research methodology

The methodology of this study is based on the modified Geosite Assessment Model (GAM), introduced by Vujičić et al. (2011), and its modification M-GAM model, developed by Tomić and Božić (2014). Original GAM i.e. M-GAM model consists of 27 subindicators, with values from 0 to 1, while M-GAM model has the importance factor (Im) first introduced by Tomić (2011) in his research. Zero marks the lowest, and one the highest value of views.

The original model consisted of two types of values (Main and additional values). When it comes to Main values, they have three types of variables Protection (*VPr*), Scenic/ Aesthetic values (*VSA*) and *Scientific/Educational value (VSE*), with total of 12 indicators. Additional values have three sorts of variables Functional values (*VFn*), Touristic values (*VTr*) with total of 15 indicators. The difference between the original GAM/M-GAM model and H-GAM model is perceived in the way we collect data. Namely, in GAM model, only experts are questioned (there are usually only few of them), while in M-GAM model, tourists are also questioned (geosite visitors), (Petrović et al., 2017).

In H-GAM model, only tourists are questioned. The authors of the paper consider that respondents' views are very important and that in this way we in fact find the most relevant data about geosite potentials (Pereira et al., 2007). Furthermore, the difference between models is in additional Health values (VHt) which have 5 indicators: Illness recovery (Rehabilitation of various injuries), Place of power (Place where the power of faith is felt), Peace and quietness (Motive for which visitors choose the geosite), Healing (Place where the visitors can feel the healing energy) and Rehabilitation (Recovery from many conditions including Covid-19).

The research took 7 years, and during this time, we analyzed the motives and opinions of 687 foreign visitors of the springs, who got to the springs by bicycle from 6 European countries. In this paper, the answers of respondents in relation to indicator Rehabilitation

(Recovery from many conditions including Covid-19), we started with the supposition that the majority of visitors came to the destination with the exact reason to recover from certain illness, i.e. that spending time at the destination helps them.

That supposition was at the same time a second hypothesis of the paper. To elaborate on this, we discussed this in an interview with the respondents. The questions are grouped according to similarity and are represented as such in the paper.

Table 1. Overall

Country of origin		**Frequency**
Valid	Croatia	60
	Austria	224
	Germany	235
	Switzerland	72
	Slovenia	42
	Hungary	54
	Total	687
Education level		**Frequency**
Valid	Elementary	71
	Secundary	130
	Bachelor	276
	MSc	145
	PhD	20
	MD	45
	Total	687

Source: Authors' research

The obtained data were analyzed by appropriate statistical methods which were descriptive and comparative in nature, enabling the explication of the research results and the performance of 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 (responses in relation to gender, age and country of origin) deviated from the frequencies that were expected.

This test aimed to check if there is a connection among groups of participants and the probability of connection. In this paper, we assumed that there would be no difference in the responses regarding participants' gender, age structure and origin country. This test aimed to check if there is a connection among these six 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.

In order to detect differences in the responses measured on the basis of statistically significant differences in the distribution of the dependent variable in relation to independent, statistically significant differences are taken for those having $p < 0,05$. The participants replied in Likert scale which is shown in Table 2. One (1) marks the highest values, while zero (0) marks the lowest.

Table 2. Numerical indicators and their description

H-GAM Subindicators	Grades (0-1)				
	0	0.25	0.5	0.75	1
VHt	None	Low	Moderate	High	Utmost

Note: The grades of the subindicators are shown in details

Results and discussion

By analyzing Table 2, it can be concluded that there were more female respondents than male, aged 31 to 45 (326), and 16 to 30 years (282). All other age groups were present in lower percentage.

Table 3. Gender and age

Gender		Frequency
Valid	Male	292
	Female	395
	Total	687
Age		Frequency
Valid	Under 15	13
	16-30	282
	31-45	326
	46-60	43
	61-75	16
	Over 76	7
	Total	687

Source: Authors' research

Respondent's answers in relation to the country of origin have shown, in the highest number of cases, despite the country of origin, that respondents agreed that the geosite "Sofia's springs" enables recovery from various illnesses. It is interesting that the highest percentage of respondents gave highest mark to this opinion, exactly 220 of them from Germany, 212 from Austria and so on.

A very small percentage of respondents, only a few of them, answered that they were neutral in opinion, and none of them answered that they did not feel any healing energy at the geosite.. This means that a total number of 650 respondents (94.6%) gave the highest mark to this geosite, when it comes to the healing powers of this place, and despite the country of origin. It should be mentioned that exactly these two countries, Germany and Austria, are leading when it comes to sports and recreational tourism, travelling by bicycle, staying in rural areas and leading a healthy lifestyle. (Nicoletta, Servidio, 2012; Hudde, 2021).

Table 4. Respondent's Opinions about the Geosite Significance for the Recovery in Relation to the Country of Origin

			Recovery from many conditions including Covid-19			Total
			0.50	0.75	1	
Country of origin	Croatia	Count	0	1	59	60
		% of Total	,0%	,1%	8,6%	8,7%
	Austria	Count	3	9	212	224
		% of Total	,4%	1,3%	30,9%	32,6%
	Germany	Count	0	15	220	235
		% of Total	,0%	2,2%	32,0%	34,2%
	Switzerland	Count	2	3	67	72
		% of Total	,3%	,4%	9,8%	10,5%
	Slovenia	Count	0	1	41	42
		% of Total	,0%	,1%	6,0%	6,1%
	Hungary	Count	0	3	51	54
		% of Total	,0%	,4%	7,4%	7,9%
Total		Count	5	32	650	687
		% of Total	,7%	4,7%	94,6%	100,0%

Source: Authors' research

Referring the data from table 5, it can be concluded that there are no statistically significant difference in participants' responses depending on the country they come from, since p=0.300.

Table 5. Pearson Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11,774[a]	10	0,300

When it comes to age groups, it is a similar situation to the previous answers, so both Table 6 and Table 7 show that there is no statistically significant difference in respondent's answers in relation to age, since p=0,125, i.e. the highest percentage of respondents, 94,6% gave the highest mark to the geosite, when it comes to the healing energy, and despite age.

Table 6. Respondent's Opinions about the Geosite Significance for the Recovery in Relation to Age

			Recovery from many conditions including Covid-19			Total
			0.50	0.75	1	
Age	Under 15	Count	0	0	13	13
		% of Total	,0%	,0%	1,9%	1,9%
	16-30	Count	3	10	269	282
		% of Total	,4%	1,5%	39,2%	41,0%
	31-45	Count	0	18	308	326
		% of Total	,0%	2,6%	44,8%	47,5%
	46-60	Count	2	3	38	43
		% of Total	,3%	,4%	5,5%	6,3%
	61-75	Count	0	1	15	16
		% of Total	,0%	,1%	2,2%	2,3%
	Over 76	Count	0	0	7	7
		% of Total	,0%	,0%	1,0%	1,0%

		Recovery from many conditions including Covid-19			Total
		0.50	0.75	1	
Total	Count	5	32	650	687
	% of Total	,7%	4,7%	94,6%	100,0%

Source: Authors' research

Table 7. Pearson Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15,210[a]	10	0,125

Source: Authors' research

Also Table 9 confirms that there is no statistically significant difference in respondent's answers in relation to gender, i.e. that both male and female respondents have equal opinion when it comes to this geosite. (Tabela 8). By this we proved the initial hypothesis of the paper that the geosite "Sofia's springs", has a potential to provide development of a rural area.

Table 8 The Respondent's Opinion about Geosite Significance for the Recovery in Relation to Gender

			Recovery from many conditions including Covid-19			Total
			0.50	0.75	1	
Gender	Male	Count	4	20	268	292
		% of Total	,6%	2,9%	39,0%	42,5%
	Female	Count	1	12	382	395
		% of Total	,1%	1,7%	55,6%	57,5%
Total		Count	5	32	650	687
		% of Total	,7%	4,7%	94,6%	100,0%

Source: Authors' research

Table 9. Pearson Chi-Square

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8,543[a]	2	0,014

Source: Authors' research

Table 10 shows respondent's answers, in a form of an interview, to the questions about the reasons for visiting the geosite "Sofia's springs". The questions are grouped according to the similarity, and here are the answers which could be grouped in the same way. The highest number of respondents answered that the reason for coming to the geosite is that they believe those visits will help them (110), furthermore, because they feel better even though they cannot explain it (85 respondents). A certain number of respondents claimed they are cured and recovered (67), and the equal number of respondents (51 each), answered that they "believe in miracles", i.e. that their recovery lasted less from the moment they started coming to the geosite.

Table 10. The Reasons for Participants Visit of the Geosite

		Frequency	Percent
Valid	I heard that the place has the power to heal	28	4,1
	I believe in miracles	51	7,4
	I have already visited the place, but I am coming back since I felt something which I cannot explain	21	3,1
	My health status is better from the moment I started coming here	38	5,5
	This is a place of faith	43	6,3
	This place is beneficial for my body	36	5,2
	From the moment I come here, I feel more positive, energetic and healthier	26	3,8
	I solved my health problems which I was not able to solve by conventional methods	18	2,6
	The surroundings are incredible and pleasant to my organism	29	4,2
	I am cured	10	1,5
	I feel overwhelmed while I am in the circle. I cannot explain it, but I feel better	85	12,4
	I am cured and recovered	67	9,8
	My recovery lasted less from the moment I started coming here	51	7,4
	I feel energy and it helps me	36	5,2
	I believe that this place has healing powers	38	5,5
	I am coming because I believe it will help me	110	16,0
	Total	687	100,0

Source: Authors' research

By summarizing responses of participants, it can be concluded that all of them came to the geosite because they believe that it has the energy which they feel here and which helps. This proves the sub-hypothesis 2, that the respondents came to the destination to recover from a certain illness, i.e. that staying at the destination helps them.

Conclusion

If we look at respondents' answers referring to *Health values* (Vht), we can conclude that the geosite Sofia's springs have a great potential to become one of a leading centre of health tourism. Special attention is given to Health values (VHt) which have 5 indicators.

One of the indicators refers to the current global issue i.e. Covid-19: "Recovery from many conditions including Covid-19". Even 650 respondents gave the highest grade to the geosite, while only 32 respondents answered 0.75. This means that the respondents, both those who are for the first time here and those who returned, felt positive effects of the healing powers of the geosite. Among the respondents there were those who came over Covid-19. They were talked to and they agreed that they felt that the geosite was helping them in rehabilitation, i.e. recovery from this difficult and complicated disease.

What made them come to the geosite are primarily the healing power and bio energy of the geosite, which is, in any case, indisputable. Good geo traffic connection of the

geosite, which is located on the territory of the national park Fruška Gora, having the important roads and the Dunube Cycle Path, as well as the vicinity of the most eminent and receptive centres of Serbia, Novi Sad and Belgrade, make this geosite a great resource for health tourism development. The fact that the energy felt on the geosite helps in solving post Covid-19 problems, is a basis from which it should be started when considering the further steps of health tourism development.

Also, it can be concluded that this issue really needs to be researched by medical science, in more details, in the future, because the respondents in this paper have expressed indeed quite a high degree of satisfaction in terms of health, which invites medical science to examine it in detail and confirm or reject it.

One thing is for certain, every potential should be used, and every "crisis" should be turned into competitive advantage. This research showed that also the pandemic can be used for the purpose of tourism, in the same way as other resources (Mathijsen, 2019; Vuković et al., 2019) i.e. that Dry spa has the power of rural destination development.

Conflict of interests

The authors declare no conflict of interest.

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ADAPTIVE CAPACITY TO CLIMATE CHANGE AND FOOD SECURITY AMONG FARM HOUSEHOLDS IN SOUTHWEST NIGERIA

Shakirat Ibrahim[1], Michael Omonitan[2], Raheem Aminu[3], Funminiyi Oyawole [4], Aisha Arowolo[5], Idris Ayinde [6]

**Corresponding author E-mail: r.o.aminu@pgr.reading.ac.uk*

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ABSTRACT

Smallholder farming households represent one of groups most exposed to the vagaries of climate change because their production and livelihood depend on climatic elements. This study assessed the effect of climate change adaptive capacity on smallholder farming households' food security in Oyo State, Nigeria. Data from 246 farming households were analysed using factor analysis to generate the Climate Change Adaptive Capacity Index (CCACI), Foster-Greer-Thorbecke Indices and Logit Regression. The most adopted adaptation strategies were intercropping, fallowing, fertilizer application, and crop rotation. Most of the households had moderate or high adaptive capacity to climate change. Econometric results show that farm households with low climate change adaptive capacity have a greater likelihood of being food insecure relative to farm households with moderate and high climate change adaptive capacity. These findings emphasize the need to enhance smallholder farmers' capacity to mitigate the adverse effect of climate change on national food security.

1 Shakirat Ibrahim, Senior Lecturer, Department of Agricultural Economics and Farm Management, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria, E-mail: ibrahimsb@funaab.edu.ng, ORCID ID (https://orcid.org/0000-0002-3261-263X)

2 Michael Omonitan, Graduate Student, Department of Agricultural Economics and Farm Management, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria, E-mail: mikokoomonitan@gmail.com

3 Raheem Aminu, PhD Student, 2School of Agriculture, Policy and Development, University of Reading, Reading, United Kingdom, E-mail: r.o.aminu@pgr.reading.ac.uk, ORCID ID (https://orcid.org/0000-0003-4746-354X)

4 Funminiyi Oyawole, Assistant Lecturer, Department of Agricultural Economics and Farm Management, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria, E-mail: oyawolefp@funaab.edu.ng, ORCID ID (https://orcid.org/0000-0001-5899-7120)

5 Aisha Arowolo, Lecturer 1, Department of Agricultural Economics and Farm Management, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria, E-mail: arowoloao@funaab.edu.ng, ORCID ID (https://orcid.org/0000-0003-2184-108X)

6 Idris Ayinde, Professor, Department of Agricultural Economics and Farm Management, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria, Email: ayindeia@funaab.edu.ng, ORCID ID (https://orcid.org/0000-0003-1815-609X)

Introduction

The climate in Nigeria has been changing. Sustained increases in temperature, variation in rainfall, flooding, sea levels, land degradation, extreme weather events, loss of biodiversity, and the affected freshwater resources over time serve as a clear indication. The temperature has increased significantly since the 1980s and the future climate projections indicate rises in temperature and rainfall variations across all ecological zones in Nigeria (Haider, 2019). Sub-Saharan Africa's (SSA) food production is mainly driven by smallholder farming households, who significantly practice rain-fed agriculture, making them susceptible to the negative consequences of climate change (Joshua et al., 2016; Makate, et al., 2018; Oyawole et al., 2019; Dhakal et al., 2022).

These climatic vagaries could severely impact food production, thereby affecting food consumption and the farm households' food security. This makes adaptation a critical component in minimizing the negative impacts of climate change while ensuring food security, especially among smallholder farming households. In SSA, different adaptation measures are used by agricultural households to combat climate change. Some of these include the adoption of drought tolerant varieties, changing planting dates, adoption of irrigation and water harvesting schemes among others (Wossen et al., 2014; Adeagbo, Ojo and Adetoro, 2021; Zakari et al., 2022). The adoption of these strategies by smallholder farm households could indicate potential climate change adaptation which improves their odds of being food secure. However, as Chepkoech et al. (2020) argue, the adaptive capacity of the individual households (i.e., 'their control over tangible and intangible resources') directly influences their decision on whether or not to implement these adaptation measures.

The Intergovernmental Panel on Climate Change (2014) defines climate change adaptive capacity "as the ability of systems, institutions, humans and other organisms to adjust to climate change (including climate variability and extremes), to moderate potential and actual damages, to take advantage of opportunities, and to cope with consequences". Climate change adaptation capabilities is intricately connected to food security. Individual or household access to information, physical (assets), financial, human resources and basic infrastructure may either limit or enhance their climate change adaptive capacity, which will in turn influence their climate change adaptation behavior and thereby impact their "physical and economic abilities to access sufficient, safe and nutritious food required for their dietary needs" (Perez-Escamilla and Segall-Correa, 2008). However, while there have been various studies examining the adoption of adaptation strategies as well as climate change adaptive capacity among farm households, there are limited studies that empirically investigate the relationship between climate change adaptive capacity and food security in SSA.

For instance, while Connolly-Boutin and Smit (2016) provided an important framework for understanding the linkage between climate change adaptation and food security, others examined climate change adaptive capacity at the city-level in Kenya and Nigeria among others (Leal Filho et al., 2019). Other studies focused on describing the various

adaptation measures deployed by farming households to mitigate climate change effects and what factors influenced such adoption decisions (Ojo and Baiyeghuni, 2020; Adeagbo, Ojo and Adetoro, 2021). Based on the Sustainable Livelihood Framework, Abdul-Razak and Kruse (2017) and Chepkoech et al (2020) conceptualized and estimated a climate change adaptive capacity index using household-level data from Ghana and Kenya respectively. This study adds to the body of knowledge by identifying various climate change adaptation measures utilized by farming households, estimating their level of adaptive capacity to climate change, and modelling its effect on their food security status among other covariates in Oyo State, Nigeria. This will provide empirical basis for designing effective policies and interventions needed to strengthen smallholder farmers' climate change adaptive capacities for improved food security and overall wellbeing.

Materials and methods

Study Area

The study was conducted in Oyo State, South-west, Nigeria. The State lies on latitude 8.0°N and longitude 4.0°E. Oyo State's weather is tropical, having dry and wet seasons as well as a comparatively high humidity level. The rainy season runs from April to October, whereas the dry season is from November to March. The typical daily temperature is between 25 °C (77.0 °F) and 35 °C (95.0 °F). (OYSG, 2022). The majority of Oyo State residents work in the agricultural sector (production, processing, marketing etc). Oyo State's climate supports the planting of various staple crops like yam, maize, soyabean, cassava and plantains as well as cash crops like oil palm, cashew and cocoa (Olawale et al., 2021).

Sampling Technique

This study used primary data collected from smallholder agricultural households selected using a multistage sampling procedure. In the first stage, 2 ADP zones (Ibadan/Ibarapa zone and Saki zone) were selected randomly from the 4 ADP zones in Oyo State using the simple random sampling technique. In the second stage, proportionate stratified sampling was used to select 2 blocks in the Saki zone and 3 blocks in the Ibadan/Ibarapa zone, considering the number of blocks in each zone. The third stage involved selecting 2 cells each from each of the blocks to make 10 cells and, finally, a random sampling of 25 respondents per cell to give a total of 250 respondents. It should be noted that data collected from 4 respondents were unusable because of a high incidence of missing responses, thereby led to the data being excluded from data analysis. The main types of data collected for this study include household demographic characteristics, climate change adaptation strategies adopted and household expenditure.

Analytical Techniques

Descriptive Statistics

The respondents' socio-economic characteristics, the adopted climate change adaptation strategies, and the perception of the respondents to climate change impacts were described using descriptive statistical measures such as tables, frequencies, means, and percentages.

Climate Change Adaptive Capacity Measurement: Factor Analysis

The respondents' climate change adaptive capacity index was generated using Factor Analysis. This involved collapsing the variables representing the sub-indicators of adaptive capacity into fewer orthogonal uncorrelated factors that proxy for the climate change adaptive capacity index. Following Eakin and Borjorquez-Tapia (2008), each respondent's climate change adaptive capacity (as highlighted in Table 1) was analysed using five indicators, and twenty-five sub-indicators of adaptive capacity. These were physical resources, human resources, financial resources, information, and livelihood diversity.

Table 1. Description of Climate Change Adaptive Capacity Indicators and Sub-Indicators

Indicators	Sub-Indicators	Description
Human Resources	Knowledge in farming	The respondent's length of time in farming. The number of years the household head spent pursuing formal education.
	Household head education	
	Percentage of adults having primary education	The proportion of adults in the household with some formal elementary education as a percentage of the total adults in the household. The number of adults in the household is expressed as a percentage of the total number of household members
	Proportion of adults in the household	
	Sick or Ill members	Number of sick or ill members the household has
Physical Resources	Farm size	The farm size cultivated in hectares
	Irrigation	Irrigation facility source used on the farm
	Ownership of farm implements and machines	The number of productive farm implements and machines possessed by the farming household
	Farm tenure	Farm tenancy type
	Access to healthcare	If the respondents have access to formal healthcare facilities in their community
	Access to transportation network	If the respondents have access to good road network linking their community to markets and other communities
Financial Resources	Remittances from relatives	The amount of remittances/regular financial help gotten by the household
	Value of animal units	The estimated total worth of animals the household owned and reared.
	Gets financial support/subsidy from the government	If the respondent often obtains government financial aid or subsidy for farming.
	Credit access	If the respondent has access to credit (formal or informal) facilities, or if they have accessed credit to finance farming in the last 5 years

Indicators	Sub-Indicators	Description
Information	Climate change awareness	If the respondent is aware of the causes and effects of climate change on agricultural production
	Training on soil management	If the respondent received training on sustainable soil resource management practices from institutions
	Training on environmental management	If the respondent received training on sustainable environmental management practices from institutions
	Receives extension assistance or education	If the farmer enjoyed agricultural services, has consulted or received agricultural education from agricultural extension agents
	Membership in farmers' organisation	If the respondent belongs to any farmers' organisation
	Sources of climate information	The number of climate data sources that the farmer has access to.
Livelihood Diversity	Number of livelihood or income sources	The number of all sources of livelihood or income available to the household
	Percentage of cultivable crop land not cultivated	The proportion of cultivable land that is not used for growing crops
	Number of crops cultivated	The total quantity of crops grown annually If the respondent practices crop diversification
	Crop diversification	

Factor analysis assumes that variance of the original variables representing the sub-indicators of climate change adaptive capacity is made up of variance accounted for by the unique factors (error terms) as well as variance accounted for by the common factors. The model specification for the Factor Analysis is expressed as:

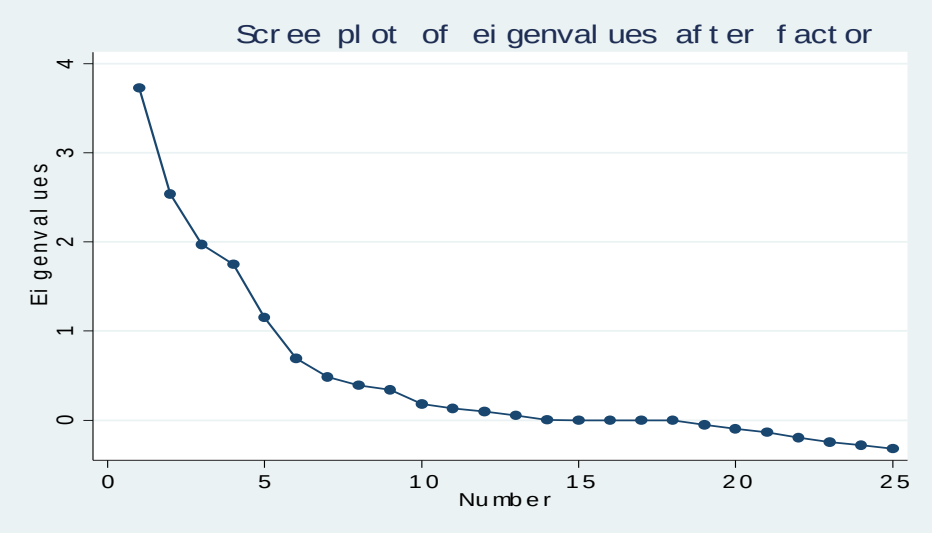
$$\begin{aligned} X_1 &= \vartheta_{11}F_1 + \vartheta_{12}F_2 + \cdots + \vartheta_{1n}F_n + \varepsilon_1 \\ X_2 &= \vartheta_{21}F_1 + \vartheta_{22}F_2 + \cdots + \vartheta_{2n}F_n + \varepsilon_2 \\ X_3 &= \vartheta_{31}F_1 + \vartheta_{32}F_2 + \cdots + \vartheta_{3n}F_n + \varepsilon_3 \\ X_{25} &= \vartheta_{251}F_1 + \vartheta_{252}F_2 + \cdots + \vartheta_{25n}F_n + \varepsilon_{25} \end{aligned} \quad (1)$$

Where X_1 to X_{25} are the original twenty-five variables representing the sub-indicators of climate change adaptive capacity; ϑ_{i1} to ϑ_{in} are the rotated factor loadings in relation to the twenty-five variables; F_1 to F_n are the standardized uncorrelated common factors; and ε_i represent the independently and identically distributed error terms with zero mean in relation to the twenty-five original variables.

Computation of Composite Index of Climate Change Adaptive Capacity

From the Factor Analysis, five factors were retained following the Kaiser criterion and the scree plot rule (Dunteman, 1989). Based on the Kaiser criterion, we retained factors having eigenvalue of at least one, and the scree plot rule involves retaining factors having sudden drop in their eigenvalues after the first factor. The scree plot is the graphical representation of the factors' eigenvalues. The scree plot is used to indicate points of significant drop and levelling off of the factors' eigenvalues. The five retained factors cumulatively explain about 91.4 percent of the total variation in the twenty-five variables representing the sub-indicators of climate change adaptive capacity.

Figure 1. Scree plot of eigenvalues on Sub-indicators of Climate Change Adaptive Capacity



The five retained factors were rotated orthogonally to reduce the number of sub-indicator variables with high factor loadings[7], thereby making each factor distinct and uncorrelated with other factors and for easy interpretation of the factors. Thereafter, the scores of each retained factor for each respondent was predicted as a weighted[8] sum of the standardized sum of the sub-indicator variables representing climate change adaptive capacity. In order to obtain each respondent's composite index of climate change adaptive capacity, the predicted factor scores were aggregated by estimating the average predicted score across the five retained factors. Similarly, for easy interpretation of the aggregated index of climate change adaptive capacity in terms of percentage, the minimum-maximum normalization method was applied.

$$CCACI_{i,normalised} = \frac{CCACI_i - CCACI_{MIN}}{CCACI_{MAX} - CCACI_{MIN}} \quad (2)$$

Where $CCACI_{i,normalised}$ is the normalised overall index of climate change adaptive capacity for each respondent, ranges between zero and one; $CCACI_i$ is each respondent's climate change adaptive capacity index to be normalized; $CCACI_{MIN}$ denotes the minimum value of the climate change adaptive capacity index; $CCACI_{MAX}$ is the maximum value of the climate change adaptive capacity index.

7 Factor loadings are the correlation between the factors and the original indicator variables.

8 The weights were the predicted scoring coefficients

Table 2. Categorization of the Adaptive Capacity Levels

Adaptive Capacity Level	Ranges of Climate Change Adaptive Capacity Indices
Low Adaptive Capacity	0 – 0.33
Moderate Adaptive Capacity	0.34 – 0.66
High Adaptive Capacity	0.67 – 1.00

Food Insecurity: Foster, Greer and Thorbecke (FGT) Indices

The Foster, Greer, and Thorbecke indices were used to determine the incidence, depth and severity of food insecurity among the respondents. These indices have been widely applied in empirical studies because they are reliable and additively decomposable (Oyinbo and Olaleye, 2016). Following Ibrahim et al. (2019) and Ogunniyi et al. (2021), this study used the two-thirds of the mean monthly per capita household food expenditure (MPCHFE) as the household food security line.

The FGT index can be expressed generally as follows:

$$P_{\propto} = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{Z - Y_i}{Z}\right)^{\propto} \quad (3)$$

Where:

$P_{\propto}$ = Foster, Greer and Thorbecke index ($0 \leq P \leq 1$)

N = total number of respondents i.e. the total farming households sampled

q = number of respondents below the food security line i.e. the number of food insecure people

z = the food security line [defined as 2/3 of mean Per-capita daily food expenditure of the ith sampled household]

Y_i= Per-capita monthly food expenditure of the ith household

α = non-negative food security aversion parameter (0, 1 or 2); where P0 = food insecurity headcount; P1 = food insecurity depth and P2 = food insecurity severity respectively

Logit Regression Model

The logistic model was employed to determine the effect of adaptive capacity to climate change and other socioeconomic characteristics on the farming households' food security status in the study area. Logit regression is applicable because the dependent variable is dichotomous (binary) and not continuous (Greene, 2008), which indicates whether or not the farming household is food secured. The model is explicitly stated thus;

$$Y^* = X\beta + \varepsilon$$

$$Y_i = \begin{cases} 1 & if\ Y_i^* > 0 \\ 0 & otherwise \end{cases} \quad (4)$$

Where:

Y* is the underlying response variable in which Y_i = 1 if household is food insecure, and 0 if food secure

x_1= Sex of household head (1 if male, 0 female)

x_2= Age of household head (in years)

x_3= Household size (number of persons in the household)

x_4= Household head's years of formal education (number)

x_5= Cultivated land area (in hectares)

x_6= Extension contacts (1 if household had access to government extension, 0 otherwise)

x_7= Credit access (1 if access, 0 if otherwise)

x_8= Farmers' association membership (1 if the farmer is a member, 0 if otherwise)

x_9= Moderate Climate Change Adaptive Capacity (1 if household has moderate adaptive capacity, 0 otherwise)

x_{10}= High Climate Change Adaptive Capacity (1 if household has high adaptive capacity, 0 otherwise)

Results and Discussion

Descriptive Statistics of Respondents' Socioeconomics Characteristics

Table 3 presents the socioeconomic characteristics of the sampled households. Most farming households are male headed, with an average age of 48 years and a household size of 7 persons. This indicates that most household heads are still economically active, more receptive to innovation, and can withstand the stress involved in agricultural production as well as adapt to climate change, given their access to and willingness to utilise modern information and technology (Gbetibouo, 2009; Jiri, Mafongoya and Chivenge, 2017). About two-thirds (64.6%) of the household heads completed at least primary education, while 34.1% had no formal education. Ali and Erenstein (2017) explained that educated farming households are more likely to be aware of and adopt agricultural methods and innovations to cope with climate risk. The mean farm size is 3.2 ha. About 47.2% of the farming household heads belong to a farmers' association, and 53.7% of them had contacts with extension agents, while credit was accessible by just 29.7% of the farming households.

Table 3. Descriptive Statistics of the Respondents

Variables	Frequency	Percentage	Mean
Age			
20 to 30	38	15.4	
31 to 40	56	22.8	
41 to 50	49	19.9	48.1
51 to 60	51	20.7	
Above 60	52	21.1	
Sex			
Male	184	74.8	
Female	62	25.2	
Marital Status			
Single	19	7.7	
Divorced	3	1.2	
Married	210	85.4	
Widowed	14	5.7	
Education			
No Education	84	34.1	
Primary	76	30.9	
Secondary	67	27.2	
Diploma/NCE	7	2.8	6.01
HND/BSc	9	3.7	
Adult Literacy	3	1.2	
Household Size			
≤ 3	36	14.6	
4-6	104	42.3	
7-9	55	22.4	6.87
10-12	34	13.8	
> 12	17	6.9	
Farm Size (Ha)			
≤ 1	73	29.7	
1.01 – 3.00	100	40.7	
3.01 – 5.00	43	17.5	3.2
5.01 – 7.00	5	2.0	
> 7.00	25	10.2	
Extension Contact			
Yes	132	53.7	
No	114	46.3	
Access to Credit			
Yes	73	29.7	
No	173	70.3	
Membership in Farmers' Association			
Yes	116	47.2	
No	130	52.8	
Off-Farm Income			
Yes	124	50.4	
No	122	49.6	

Descriptive statistics of adaptation strategies adopted by Respondents

Table 4 presents the several adaptation strategies chosen by the respondents. The result shows that among other strategies, intercropping (83.3%), field fallowing (74.4%), fertiliser application (70.3%), crop rotation (67.9%), changes in planting period (67.1%) and mulching (64.2%) are the major adaptation strategies practised by the respondents. It was observed that most farmers intercropped cassava with maise (two major staple crops that constitute a major percentage of household diet) and with vegetables, probably to ensure household food availability. However, integrated pest and disease management (41.5%), erosion control (33.3%) and integrated water management (15.0%) were less adopted. These strategies are consistent with those reported by other studies (Ojo and Baiyeghuni, 2020; Adeagbo, Ojo and Adetoro, 2021) in Southwest Nigeria.

Table 4. Distribution of Adaptation Strategies Employed by Respondents

Adaptation Strategies	Frequency	Percentage (%)
Change in planting period	165	67.1
Erosion Control	82	33.3
Crop Rotation	172	69.9
Fertiliser Application	173	70.3
Mulching	158	64.2
Intercropping	205	83.3
Integrated pest & disease mgmt.	102	41.5
Integrated water management	37	15
Field Fallowing	183	74.4

Distribution of Respondents' Level of Climate Change Adaptive Capacity

Results shown in Table 5 indicate that most (61.0%) of the households are in the high adaptive capacity category with an average adaptive capacity score of 0.67, which falls within the high adaptive capacity level ($0.66 \leq CCACI \leq 1$). This result is in line with Chepkoech et al. (2020), who reported that about 66% of their respondents had either moderate or high capacity to adapt to climate change. However, 4.1% of the households fall in the low adaptive capacity category, suggesting that they are not well placed to adjust to the changes and uncertainties of climate, which may be detrimental to their wellbeing and livelihood.

Analysis of Farm Households' Food Security Status

Table 6 provides information about households' food security profiles and food expenditure. The mean monthly per capita household food expenditure was ₦4408.50k ($12.3), while the food security line was ₦2939.10k ($8.2). This is similar to the food security line of ₦2643.663 reported by Ogunniyi et al. (2021). Based on these, the food insecurity headcount ratio (P_0) shows that 45.0% of the households are food insecure,

with a gap (P_1) and severity index (P_2) of 0.17 and 0.09, respectively. This suggests that an average food-insecure household in this study needs 17.0% (₦499.65k ₦ $1.4) of the food insecurity line to become food secure, while 9.0% of the food insecure farm households are in very severe food poverty.

Table 6. Food Security Status of the Respondents

Food Insecurity Indices	Values
Headcount (P_0)	0.45
Gap (P_1)	0.17
Severity (P_2)	0.09
Average per capita household food expenditure (MPCHFE)	₦4408.50
Food insecurity line (2/3 of MPCHFE)	₦2939.10

Result of Logistic Regression Model

The result of the logit regression model used to determine the effect of households' climate change adaptive capacity on food security is presented in Table 7. The result shows that household size, education and adaptive capacity significantly influence food insecurity at 1%.

The result revealed that households in the low adaptive capacity category are more likely to be food insecure than those in moderate and high adaptive capacity categories. This is critical given that climatic shocks such as erratic and unpredictable rainfall are expected to reoccur in the coming years, especially in sub-Saharan Africa (Intergovernmental Panel on Climate Change IPCC, 2014). In particular, most of these smallholder farmers operate rain-fed agricultural production, which makes their livelihood highly exposed and susceptible to climatic vagaries (Srivastava *et al*., 2017; Oyawole et al., 2019).

Household size is significantly and positively correlated with household food insecurity, indicating that households with additional members are more likely to be food insecure. As Ibrahim et al. (2019) argued, this could be due to the increased total consumption needs associated with larger households, particularly those of children who are still dependents and are unlikely to be economically productive and yet utilise a significant proportion of household income. This is in tandem with Ogunniyi et al. (2018), who reported that households with additional members are likely to have less food expenditure per capita, thus negatively affecting food security.

Furthermore, education negatively influences the probability of household food insecurity. This suggests that additional years of education received by the head of household will likely result in the household being food secure. This may be because knowledgeable farmers tend to adopt modern agricultural technology to increase their productivity and adapt to climate change with climate risk, thus ensuring greater agricultural output for household consumption and market sales (Ali and Erenstein, 2017). In addition, higher educational attainment is largely associated with better job opportunities and, consequently, increased earning potential in off-farm activities, which could provide additional household income for both consumption and farm investment (Mutisya *et al*., 2016; Ogunniyi *et al*., 2021)

Table 8. Logistic Regression Results for the Effect of Climate Change Adaptive Capacity on Household Food Security

Variables	Coefficient	Standard Error	z-value
Sex	0.084	0.397	0.21
Age	0.013	0.013	0.95
Household size	0.385***	0.077	5.02
Education	-0.107***	0.039	-2.72
Farm size (Ha)	0.001	0.062	0.02
Extension contacts	0.487	0.435	1.12
Credit access	-0.613	0.423	-1.45
Farm Association membership	0.342	0.454	0.75
Medium adaptive capacity	-2.596***	0.708	-3.66
High adaptive capacity	-5.644***	1.169	-4.83
Constant	-0.237	0.897	-0.26
LR chi2(10) = 57.84			
Prob > chi2 = 0.0000			
Pseudo R2 = 0.22			
Log likelihood = -100.68			

Note: 1%, 5%, and 10% level of significance are denoted by ***, **, *; represent

Conclusion

This study was designed to identify the various strategies employed by farm households in adapting to climate change, determine their adaptive capacity level, and analyse its effect on household food security in Oyo State, Nigeria. Intercropping, field fallowing, fertiliser application, crop rotation, changes in planting period, and mulching were the dominant strategies adopted by the farmers. More than half of farm households had high adaptive capacity, while few had a low adaptive capacity to climate change. However, about one-third of the households were food insecure, with a food insecurity gap and severity index of 0.17 and 0.09, respectively. The results from the logit regression model show that households with low climate change adaptive capacity have a greater probability of being food insecure relative to households with moderate and high climate change adaptive capacity.

Similarly, large households and those with uneducated heads are also likely to be food insecure. The findings of this study underscore the necessity to enhance smallholder farmers' ability to adapt to the negative impacts of climate change and its adverse effect on national food security. This includes deliberate investment in rural infrastructure (such as rural roads and communal irrigation schemes) and credit access to farming households to purchase farm implements and machinery. Furthermore, public investment in improving access to education (both children and adult literacy) in rural areas should be increased.

Conflict of interests

The authors declare no conflict of interest.

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ECONOMIC EFFECTS OF INVESTMENT IN IRRIGATION SYSTEMS IMPLEMENTATION AT THE SMALL FAMILY FARMS

Marko Jeločnik[1], Jonel Subić[2], Aleksandar Zdravković[3]

**Corresponding author E-mail: marko_j@iep.bg.ac.rs*

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ABSTRACT

Water is the source of life for all living beings, but also an irreplaceable input in agricultural production. According to the available water and land potentials in Serbia irrigation is used at generally negligible arable areas. Although it represents an agro-technical measure whose implementation usually causes significant investment costs for the farm, its application ensures high and stable yields of high quality crops' fruits, while indirectly it affects increase in incomes and continuity in farm sustainability. The main goal of the paper is presenting an assessment of the effects of investing in implementation of the irrigation system (type Tifon) on a small family farm primarily active in crop farming. Investment analysis was based on basic static and dynamic methods for assessing the effectiveness of investments. The assessment was focused to two modalities in crop production, i.e. implementation of irrigation in crop farming at 25 ha and 30 ha. In both observed modalities the investment was assessed as economically justified alternative for farm business improvement, while there are shown slightly better results with the rise of used agricultural surfaces.

Introduction

As a segment of plant agricultural production, for crop farming are linked almost all specifics of agriculture, with a significant dependence on the characteristics of available land and water resources and climate conditions.

1 Marko Jeločnik, Ph.D., Senior Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 69 72 852, E-mail: marko_j@iep.bg.ac.rs, ORCID ID (https://orcid.org/0000-0003-4875-1789)

2 Jonel Subić, Ph.D., Principal Research Fellow, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 69 72 863, E-mail: jonel_s@iep.bg.ac.rs, ORCID ID (https://orcid.org/0000-0003-1342-1325)

3 Aleksandar Zdravković, Ph.D., Research Associate, Institute of Economic Sciences, Zmaj Jovina Street no. 12, 11000 Belgrade, Serbia, Phone: +381 11 26 23 055, E-mail: aleksandar.zdravkovic@ien.bg.ac.rs, ORCID ID (https://orcid.org/0000-0002-6208-097X)

The primary importance of crop production results in ensuring food security for global population, as well as in provision of livestock nutrition, or in continuous suppling with valuable raw materials to many industries, such as food industry, light chemical and petrochemical industries, textile industry, or pharmacy and others.

Globally, in 2019, there were about 1.38 billion hectares of arable land in the function of crop production, i.e. almost 30% of available agricultural land. According to its share in used arable land, cereals dominate. In general, currently there occurs an extremely moderate growth trend in total arable land areas that is mostly the consequence of pronounced growth in world's population and strivings to secure global food security. Besides, there are certain geographical exceptions. So, in Europe and North America comes to slight decrease in arable land areas (FAO, 2022). It's primarily a result of lower population density compared to available arable land areas, or significant intensification in agricultural production, while its stronger reliance on contemporary technical and technological achievements and digitalization activities, as well as greater rate of urbanization, but also more expressed orientation to preservation of accessible natural resources, ecosystems and rural landscapes (Satterthwaite et al., 2010; FAO, 2017).

According to the research of Lowder et al. (2016), it was estimated that there is almost 460 million farms worldwide. Besides, agro-food production and crop farming is mainly organized at small family farms, where the 72% of them have the size lower than 1 ha, what is primarily pooled by the farm structure available in developing countries. Generally, most of them are practicing the rain-fed farming.

Farming is generally organized in open field, meaning that it usually faces the various natural and climate risks (Zarkovic et al., 2014). Gained results in plant production are mainly affected by the drought, and partly by hail, excessive rains, frost, etc. (Stričević et al., 2020). It has to be underlined that the water could be considered as a source of life for all living organisms, as it supports the growth, development and functioning of the most of them (Hossain, 2015). In plant production, a small but continuous loss of water could generally lead to plant stress and dehydration, affecting the further decrease in yields quantity and quality, while larger water deficit even in couple days could be a fatal for plant. What this mean for farmer? Any decrease in yields gained in dry land farming directly reflects to the level of farm profitability, as well as to lowering the farm competitiveness (Molden et al., 2010).

Although the irrigated areas are relatively small and mostly covered by modest and obsolete irrigation systems, there are certain countries with significant level of applied irrigation in practice. For example, in line to available WB dataset (WB, 2022), the largest area of irrigated land is in Suriname, Bangladesh, or Pakistan, where is irrigated more than 50% of available agricultural land. Related to developed countries with contemporary approach in agricultural production, Israel irrigates around the 30% of disposed land fund in agriculture, or Italy and Greece 19%, Spain around 12%, the Netherlands and China around 10%, or USA and France less than 6%. Some other assessment show that irrigation grows into the basic and significant precondition for

stable and efficient agro-food production, where almost 20% of available arable land is globally irrigated (Durkalic et al., 2019; Zemunac et al., 2021).

For the decades, agro-food sector has significant role in development of Serbian economy and improving of its global image. This is obvious through the high share of GDP derived from mentioned sector, around 20%, or high rate in overall employment, up to 20%, as well as positive and constantly growing export and foreign trade balance. Besides, although the national agro sector is covered with highly dispersed types of support measures, their level usually does not fit the needs of agriculture (Bogdanov & Vasiljevic, 2011; Munćan & Božić, 2013; Mitrović et al., 2017).

Within the structure of agricultural production dominates plant production that basically maintains the food security at national level, and keeps up the increase tempo of export (Stojanović, 2022; Melović, 2022). According the last census of agriculture plant production is spread at around 3.5 million ha of utilized agricultural areas, where 75% belongs to arable land. These areas are mostly under the crops, primarily grains (around 70% of them), specifically corn and wheat. Factors that generally limit the further development of crop production are small farm estates, insufficient or ad hoc use of agrochemicals and irrigation, use of obsolete mechanisation and equipment, lack of contemporary technological alternatives, low investment intensity, insufficient appliance of standardization, etc. (Zekic et al., 2013; Jelocnik et al., 2021).

Cheaper and more quality food production has become the imperative for securing the farm competitiveness (Todorović, 2018a). There is an opinion that market-oriented farms dominantly oriented to traditional crop farming (i.e. grains, oilseeds and legumes) could guarantee their sustainability and developmental orientation only with production organized on more than 20-25 ha with the full application of modern agri-techniques and GAP.

This is one of reasons why starting from production year 2014/2015 public subsidies in plant production were limited to 20 ha, what primarily supports the sustainability and survival of economically weaker farms (Todorović, 2018b). Mentioned is mostly in accordance with current average farm size (around 5.4 ha UAA) and farm's structure in Serbia, where for example over the 78% farms have less than 5 ha of UAA, while slightly over the 3% of farms cultivate over the 20 ha of UAA, where they cover over the 44% of overall fund of UAA (Bajramović et al., 2016).

In current conditions crop farmers are mainly forced to sell crops during or just after the harvest period when the price of crops is much lower. Lack of financial assets makes crops storing usually impossible, i.e. paying the public or private warehouse or building the farms' own silos, affecting the lower profitability (Zakić et al., 2014). In addition, generally there is a lack of crop production planning and recording at farms, causing the shortage in accurate data related to used agro-techniques and inputs, or volume and quality of gained yields. Rare, usually larger farms keeps recoding the Fields Book as the adequate tool in crop production management (Zakić et al., 2017).

In Serbia, crop production is usually followed by the frequent and intense heatwaves and drought, what simultaneously endanger the expected production quantity and products safety (Jeločnik & Zubović, 2018). Unfortunately, regardless of the source, irrigated areas are so modest and ranges between the 1-3% of total sum of arable land (Kljajić et al., 2013; Jević et al., 2021Pantić et al., 2021; Pavlović et al., 2017). Under the irrigation are mainly grains and silage corn, around 36% of totally irrigated surfaces (Zubović et al., 2018).

As agro-technic measure, in crop production irrigation serves to compensate any deficit of required water for optimal growth and development of plants caused by low-level rainfalls or their inadequate distribution within the vegetation that could endanger achievement of expected yields and incomes (Subić et al., 2017a). So, technically, as it secures stable and increased yields and incomes, implementation of irrigation system could be considered as certain level of value-added creation at micro level (Jeločnik & Subić, 2020). It could be mentioned that irrigation serves to boost the overall sustainability of crop farming, or even overall farm (Lewandowski et al., 1999).

The main paper goal is to estimate if the implementation of certain type of irrigation system (specifically Tifon) at small farms involved in crop production could be economically justified business step in conditions of national agriculture. In other words, previously conducted research was searched for the answer: Does the investment in irrigation in predefined models of crop production could be economically justified for crop producer?

Used Methodology

Research involved assessment of the economic effects derived from the investment into the irrigation system type Tifon that was installed and later used at the small family farm. Methodological framework for primary data collecting was based on couple in-depth interviews with the manager of the selected family farm located in the territory of South Banat District.

The analysis of previously gained data was based on the standard static (Total Output-Total Input Ratio, Net Profit Margin, Accounting Rate of Return, or Simple Payback Period) and dynamic (Net Present Value, Internal Rate of Return and Dynamic Payback Period) methods for investment effectiveness assessment (Subić, 2010). At the same time, theoretical and logical data check was done through the desktop analysis of available scientific and professional literature sources. Investment analysis was made for two production models, one that includes implementation of irrigation on 25 ha, and other on 30 ha of arable land under the field crops. All gained primary data and derived results refer to production cycle 2020/21. In order to provide certain level of results comparability, all values are presented in EUR. Besides, all data are presented in adequate tables, while they are adjusted to assumed size of production capacity.

Results with Discussion

Despite the fact that there is high necessity for irrigation in crop production in the conditions of Serbian agro-sector, this does not automatically mean that each investment in implementation of irrigation system is economically justified for the farmer. Related to this, any farm should, in accordance with its production or revenue potential, make an economic analysis of the planned investment into the establishment and later use of the selected irrigation alternative. Along the needs, farm can treat irrigation as a basic or supplementary agro-technical measure.

Observed farm is solely directed to conventional crop production, while it can be considered as farm fully oriented to market and further tech-tech development. Production is organized on 30 ha of hi-quality arable land area, where the 25 ha is owned by farm, while the rest is rented. The all production parcels are abutting each other, having the adequate shape without the slopes. Farm disposes with complete mechanization for crop farming, as well as with one draw well, facilities for storing inputs and agricultural products, and spacious garage for mechanization and equipment, etc. Farm operates as a physical person.

Agro-climate conditions that have been following the farm production for several years (occurrence of drought of moderate intensity and time mismatch of rainfalls and water needs during the vegetation period) have imposed the need for applying the irrigation as a basic measure. In line to farms' production potential and cultivated crops (winter wheat, soybean, and corn), the irrigation system type Tifon is recognized as optimal solution. With this business step farmer is expecting to strengthen and stabilize the achieved yields in all cultivated crops, or he expects to improve the efficiency in utilization of available production resources. According the used inputs, conducted agro-technical measures and manipulation with agricultural products, the farm is consistently complying the all GAP principles.

Financing the irrigation system, power generator with the pump, drilling of additional draw well, laying of the primary pipeline, or covering the corresponding part of the permanent working capital (PWC) would be done with the farm's own financial resources while certain parts will be additionally reimbursed from specific grant of the Provincial Secretariat for Agriculture, Water Management and Forestry (possibility for covering the 30-60% of the value of certain segment of the investment excluding the VAT), (PSAWMF, 2021), (Tables 1-3.).

Assessing the planned investment includes both defined production models (irrigation of 25 ha or 30 ha), while the need for this activity is to consider whether the farm would be able to successfully "service" the investment by its application at the smaller area if there comes to cancelation of lease agreement.

Table 1. Planned investment in irrigation system (in EUR)

No.	Description	Value
1.	System for irrigation – type Tifon	18,790.0
2.	Power generator with the water pump	12,810.0
3.	Installation of the primary pipeline	3,830.0
4.	Establishment of draw well	3,220.0
Total		38,650.0

Source: IAE, 2021.

In line to previously organized crop production, farmer decides to buy irrigation system type Tifon with associated equipment from local distributor (hydraulic cart, 90 mm PE hose 400 m long, water cannon with a set of 3 nozzles, some auxiliary hoses, manometer and tachometer, 6-speed gearbox, turbine and other). The minimally required pressure for the operation of the system is 5 bar (Best&Co, 2021). Tifon is run by 9 KW diesel aggregate in package with the multi-stage pump. Lack of plentiful well that is able to service the entire surface with the enough water requires the building, or drilling another draw well with accompanying equipment (upward pipe, protective sieves, valve and connector). Also, the primary pipeline (80 mm aluminium pipes, 400 m long) with adequate connectors and connection points will be installed towards connecting the draw well with Tifon.

Table 2. Structure of planned investment (in EUR)

No.	Description	Total investment	Share (in %)
1.	Fixed assets	38,650.0	90.9
2.	Permanent working capital	3,865.0	9.1
Total		42,515.0	100.0

Source: IAE, 2021.

According to the structure of planned investment, more than 90% (Table 2.) of needed financial assets is relating to fixed assets.

Table 3. Financing of planned investment (in EUR)

No.	Description	Value	Reimbursement rate (in %)	Public grant	Own assets
1.	Tifon	18,790.00	60	9,019.2	9,770.8
2.	Power generator	12,810.00	60	6,148.8	6,661.2
3.	Primary pipeline	3,830.00	30	919.2	2,910.8
4.	Draw well	3,220.00	60	1,545.6	1,674.4
5.	PWC	3,865.00	0	0.0	3,865.0
Total		42,515.00	-	17,632.8	24,882.2

Source: IAE, 2021.

In line to totally needed financial assets for the investment realisation, 41.47% will be additionally reimbursed from the public grant (Table 3.). Regardless of fact that investment will be generally covered by farms' and public financial assets, investment analysis assumes the "calculative" interest rate of 4%. Explanation lies in conservative approach considering that all needed assets originate as external financial assets, while

the used interest rate reflects the current price of borrowed capital at national level used for this purposes. Analysis assumes five years period.

Generation of farm incomes is based on crop rotation of three crops (wheat, corn and soybean), while some of crops in certain production year occur as main or subsequently sawn (second) crops. Despite the simplicity, production is highly adjusted to common agro-technic recommendations and available farm mechanisation and facilities. Farm is also user of public subsidies for crop production just for owned land area. Creation of annual farm incomes for both models is presented in next table (Table 4.). All produced crops have been selling to local agro-companies after the harvesting. Deriving from farmer's large experience in crop production it is assumed that there are no oscillations in achieved crop yields. So, in order to simplify the analysis, all values (yields, prices and subsidies) are fixed to their level obtained in 2021. Besides, in some extent lower yields than expected in crop production by the use of irrigation are caused by slightly reduced soil fertility. Completely produced quantities of each crop imply high and standardized quality that is used for human consumption. According to data from Table 4., it is obvious that rise of production capacities for 20% could lead farm to 18.45% higher cumulative gross incomes within the observed five years period (280,970.3 EUR : 332,800.3 EUR).

Table 4. Creation of farm incomes in both (25 ha and 30 ha) production models (in EUR, in EUR/t)

Element	UM	Price/UM	Quantity	Total
I model - production on 25 ha				
I year				
Corn	t	178	250	44,500.0
Subsidy (for crop production)	set	33.5	25	837.5
Reimbursement for irrigation implementation	-	-	-	17,632.8
Total				62,970.3
II year				
Wheat	t	185	162.5	30,062.5
Soybean as second crop	t	550	62.5	34,375.0
Subsidy (for crop production)	set	33.5	25	837.5
Total				65,275.0
III year				
Corn	t	178	250	44,500.0
Subsidy (for crop production)	set	33.5	25	837.5
Total				45,337.5
IV year				
Wheat	t	185	162.5	30,062.5
Corn as second crop	t	178	175	31,150.0
Subsidy (for crop production)	set	33.5	25	837.5
Total				62,050.0
V year				
Corn	t	178	250	44,500.0
Subsidy (for crop production)	set	33.5	25	837.5
Total				45,337,5
II model - production on 30 ha				

Element	UM	Price/UM	Quantity	Total
I year				
Corn	t	178	300	53,400.0
Subsidy (for crop production)	set	33.5	25	837.5
Reimbursement for irrigation implementation	-	-	-	17,632.8
Total				71,870.3
II year				
Wheat	t	185	195	36,075.0
Soybean as second crop	t	550	75	41,250.0
Subsidy (for crop production)	set	33.5	25	837.5
Total				78,162.5
III year				
Corn	t	178	300	53,400.0
Subsidy (for crop production)	set	33.5	25	837.5
Total				54,237.5
IV year				
Wheat	t	185	195	36,075.0
Corn as second crop	t	178	210	37,380.0
Subsidy (for crop production)	set	33.5	25	837.5
Total				74,292.5
V year				
Corn	t	178	300	53,400.0
Subsidy (for crop production)	set	33.5	25	837.5
Total				54,237.5

Source: IAE, 2021.

Following tables (Tables 5-11.) provide the overview of all costs incurred during the crops production under the irrigation. The most of used inputs are purchased in local retails, while the applied norms correspond to GAP and adequate suggestions of the local agri-extension adjusted to available microclimate and production conditions. Related to costs of used direct material (Table 5.), all crop seeds are locally verified high yielding crop varieties, while all agro-chemicals are approved for the use at national level. Deficit of manure at local level and high costs of its potential transport have been directing the farm to use of slightly increased doses of complex mineral fertilizers during the pre-sowing period and crop vegetation. Depending on sown crop, pesticides are applied through 2-4 treatments. In order to reduce the total costs, the consolidated quantities of agro-chemistry are purchased. Disposing with draw wells at own property, farm is exempt from paying the costs of used water.

Table 5. Sum of costs of direct material in both (25 ha and 30 ha) production models (in EUR)

No.	Element	Year				
		I	II	III	IV	V
Crop production – I model (25 ha)						
1.	Seeds	4,132.5	6,100.0	4,132.5	6,732.5	4,132.5
2.	Mineral fertilizers	16,000.0	13,700.0	16,000.0	14,575.0	16,000.0
3.	Pesticides	2,732.5	4,515.0	2,732.5	4,150.0	2,732.5
Total		**22,865.0**	**24,315.0**	**22,865.0**	**25,457.5**	**22,865.0**

No.	Element	Year				
		I	II	III	IV	V
Crop production – II model (30 ha)						
1.	Seeds	4,959.0	7,320.0	4,959.0	8,079.0	4,959.0
2.	Mineral fertilizers	19,200.0	16,440.0	19,200.0	17,490.0	19,200.0
3.	Pesticides	3,279.0	5,418.0	3,279.0	4,980.0	3,279.0
Total		**27,438.0**	**29,178.0**	**27,438.0**	**30,549.0**	**27,438.0**

Source: IAE, 2021.

Costs of energy cover fuel spent for mechanized operations carried out by available farm mechanisation and equipment, as well as fuel spent for running the implemented irrigation system. In line to quite even requirements of crops toward the water and mechanized operations over a longer period, both models could relay to annually stable energy costs (Table 6.).

Table 6. Sum of costs of used energy in both (25 ha and 30 ha) production models (in EUR)

No.	Element	Year				
		I	II	III	IV	V
Crop production – I model (25 ha)						
1.	Fuel - mechanisation	6,427.5	9,600.0	6,427.5	9,505.0	6,427.5
2.	Fuel - irrigation	2,657.5	5,312.5	2,657.5	5,312.5	2,657.5
Total		9,085.0	14,912.5	9,085.0	14,817.5	9,085.0
Crop production – II model (30 ha)						
1.	Fuel - mechanisation	7,713.0	11,520.0	7,713.0	11,406.0	7,713.0
2.	Fuel - irrigation	3,189.0	6,375.0	3,189.0	6,375.0	3,189.0
Total		10,902.0	17,895.0	10,902.0	17,781.0	10,902.0

Source: IAE, 2021.

Annual costs of maintaining the irrigation system or used mechanization and equipment in both model assumes fixed sums (Table 7.). They cover regular service, as well as small repairs, or any action that prevents stoppage of production caused by broken mechanization.

Table 7. Sum of other material costs in both (25 ha and 30 ha) production models (in EUR)

No.	Element	Year				
		I	II	III	IV	V
Crop production – I model (25 ha)						
1.	Maintaining of irrigation system	169.7	169.7	169.7	169.7	169.7
2.	Maintaining of equipment and mechanization	678.7	678.7	678.7	678.7	678.7
Total		848.4	848.4	848.4	848.4	848.4
Crop production – II model (30 ha)						
1.	Maintaining of irrigation system	203.6	203.6	203.6	203.6	203.6
2.	Maintaining of equipment and mechanization	814.5	814.5	814.5	814.5	814.5
Total		1,018.1	1,018.1	1,018.1	1,018.1	1,018.1

Source: IAE, 2021.

Depreciation rate and its value are adjusted to expected period of use of implemented irrigation system (Table 8.). General suggestion considers the use of the system by optimal intensity up to ten years and further moment of the investment maintaining carrying out. Considering the case that the same investment is used in both models, the value of previously determined salvage value is unique (undepreciated book value of fixed assets increased for PWC), while it is limited by the usual duration of credit line used for that purposes (five years).

Table 8. Value of depreciation (in EUR)

Investment	Retail price (excluding VAT)	Investment life cycle (year)	Depreciation rate (in %)	Value of depreciation	Credit life cycle (years)	Salvage value
Fixed assets	**38,650.00**	**10**	**10.00**	**3,865.00**	5	**19,325.00**
PWC	3,865.00	-	-	-	-	**3,865.00**
Salvage value - total		-	-	-	-	**23,190,00**

Source: IAE, 2021.

Crop production under irrigation initiates the labour costs (Table 9.) derived from the employment of 2 farm members and 1 external employee in both models, while the sum of costs appeared in second model is for 20% higher. All persons involved in production activities are highly skilful and well experienced.

Table 9. Sum of labour costs in both (25 ha and 30 ha) production models (in EUR)

No.	Element	Number of employees	Share in total no. of employees (in %)	No. of working months	Gross salary per month	Gross salary - total
Crop production – I model (25 ha)						
I	**Full employees**	2	66.66	4	425.00	3,400.00
II	**Seasonal employees**	1	33.33	2	425.00	850.00
Total		**3**	**100.00**	-	-	**4,250.00**
Crop production – II model (30 ha)						
I	**Full employees**	2	66.66	5	425.00	4,250.00
II	**Seasonal employees**	1	33.33	2	425.00	850.00
Total		**3**	**100.00**	-	-	**5,100.00**

Source: IAE, 2021.

Both production models are burdened by certain non-material costs (Table 10.) that mutually differ primarily related to size of cultivated land area. They involve few national taxes, as are property and irrigation tax, annual laboratory analyses of soil fertility and water quality, general crop insurance, land renting and other non-material costs. Second model generates for 89% higher costs, before all as it involves land renting of 5 hectares.

Table 10. Sum of non-material costs in both (25 ha and 30 ha) production models (in EUR)

No.	Element	Year				
		I	II	III	IV	V
Crop production – I model (25 ha)						
1.	Irrigation tax	775.00	775.00	775.00	775.00	775.00
2.	Part of property tax	148.00	148.00	148.00	148.00	148.00
3.	Laboratory analyses	92.50	92.50	92.50	92.50	92.50
4.	Crop insurance	424.00	424.00	424.00	424.00	424.00
5.	Other non-material costs	164.50	164.50	164.50	164.50	164.50
Total		**1,604.00**	**1,604.00**	**1,604.00**	**1,604.00**	**1,604.00**
Crop production – II model (30 ha)						
1.	Irrigation tax	930.00	930.00	930.00	930.00	930.00
2.	Part of property tax	178.00	178.00	178.00	178.00	178.00
3.	Laboratory analyses	92.50	92.50	92.50	92.50	92.50
4.	Crop insurance	509.00	509.00	509.00	509.00	509.00
5.	Land renting	1,125.00	1,125.00	1,125.00	1,125.00	1,125.00
6.	Other non-material costs	197.50	197.50	197.50	197.50	197.50
Total		**3,032.00**	**3,032.00**	**3,032.00**	**3,032.00**	**3,032.00**

Source: IAE, 2021.

Next table (Table 11.) summarise the all costs derived in crop production after the implementation and further use of irrigation system within the observed period. It could be seen that in both models material costs are dominating, while within the material costs the costs of direct materials have the highest share (over the 53%). Besides, there is certain level of annual oscillation in the cash outflow in both models, as the consequence of different production requirements of grown crops. Generally, the sum of total costs is annually for over the 20% higher in second than in first production model.

Table 11. Structure of total costs in both (25 ha and 30 ha) crop production models (in EUR)

No.	Element	Year				
		I	II	III	IV	V
Crop production – I model (25 ha)						
A.	**Material costs**	**32,798.4**	**40,075.9**	**32,798.4**	**41,123.4**	**32,798.4**
1.	Costs of direct material	22,865.0	24,315.0	22,865.0	25,457.5	22,865.0
2.	Costs of energy	9,085.0	14,912.5	9,085.0	14,817.5	9,085.0
3.	Other material costs	848.4	848.4	848.4	848.4	848.4
B.	**Non-material costs**	**9,719.0**	**9,719.0**	**9,719.0**	**9,719.0**	**9,719.0**
1.	Depreciation	3,865.0	3,865.0	3,865.0	3,865.0	3,865.0
2.	Labour	4,250.0	4,250.0	4,250.0	4,250.0	4,250.0
3.	Interest	0.0	0.0	0.0	0.0	0.0
4.	Other non-material costs	1,604.0	1,604.0	1,604.0	1,604.0	1,604.0
Total (A+B)		**42,517.4**	**49,794.9**	**42,517.4**	**50,842.4**	**42,517.4**
Crop production – II model (30 ha)						
A.	**Material costs**	**39,358.1**	**48,091.1**	**39,358.1**	**49,348.1**	**39,358.1**
1.	Costs of direct material	27,438.0	29,178.0	27,438.0	30,549.0	27,438.0
2.	Costs of energy	10,902.0	17,895.0	10,902.0	17,781.0	10,902.0

No.	Element	Year				
		I	II	III	IV	V
3.	Other material costs	1,018.1	1,018.1	1,018.1	1,018.1	1,018.1
B.	**Non-material costs**	**11,997.0**	**11,997.0**	**11,997.0**	**11,997.0**	**11,997.0**
1.	Depreciation	3,865.0	3,865.0	3,865.0	3,865.0	3,865.0
2.	Labour	5,100.0	5,100.0	5,100.0	5,100.0	5,100.0
3.	Interest	0.0	0.0	0.0	0.0	0.0
4.	Other non-material costs	3,032.0	3,032.0	3,032.0	3,032.0	3,032.0
Total (A+B)		**51,355.1**	**60,088.1**	**51,355.1**	**61,345.1**	**51,355.1**

Source: IAE, 2021.

After insight into the profit and loss statements (Table 12.) derived from the use of irrigation system in defined crop production models, it could be seen that during the observed period in both models exists the continuity in achievement of the positive business results (net profit). Along to national legislation, 10% income tax is applied. Unfortunately, there are visible oscillations (within the same model or between the models) in the value of gained profit, what is mainly the consequence of sown crops in certain year. Observed cumulatively or on annual basis, second model seems to be more profitable for farm, as in average it annually generates for 813.9 EUR higher net-profit (9,500.5 EUR : 10,314.4 EUR).

Table 12. Profit and loss statement in both (25 ha and 30 ha) crop production models (in EUR)

No.	Element	Year				
		I	II	III	IV	V
Crop production – I model (25 ha)						
I	**Total revenues (1+2+3)**	**62,970.3**	**65,275.0**	**45,337.5**	**62,050.0**	**45,337.5**
1.	Sales revenues	44,500.0	64,437.5	44,500.0	61,212.5	44,500.0
2.	Subsidies	837.5	837.5	837.5	837.5	837.5
3.	Other revenues (reimbursement)	17,632.8	0.0	0.0	0.0	0.0
II	**Total expenditures (1+2)**	**42,517.4**	**49,794.9**	**42,517.4**	**50,842.4**	**42,517.4**
1.	Business expenditures	42,517.4	49,794.9	42,517.4	50,842.4	42,517.4
1.1.	Material costs	32,798.4	40,075.9	32,798.4	41,123.4	32,798.4
1.2.	Non-material costs without depreciation and interest	5,854.0	5,854.0	5,854.0	5,854.0	5,854.0
1.3.	Depreciation	3,865.0	3,865.0	3,865.0	3,865.0	3,865.0
2.	Financial expenditures	0.0	0.0	0.0	0.0	0.0
2.1.	Interest	0.0	0.0	0.0	0.0	0.0
III	**Gross profit (I-II)**	**20,452.9**	**15,480.1**	**2,820.1**	**11,207.6**	**2,820.1**
IV	**Income tax**	2,045.3	1,548.0	282.0	1,120.8	282.0
V	**Net profit (III-IV)**	**18,407.6**	**13,932.1**	**2,538.1**	**10,086.8**	**2,538.1**
Crop production – II model (30 ha)						
I	**Total revenues (1+2+3)**	**71,870.3**	**78,162.5**	**54,237.5**	**74,292.5**	**54,237.5**
1.	Sales revenues	53,400.0	77,325.0	53,400.0	73,455.0	53,400.0
2.	Subsidies	837.5	837.5	837.5	837.5	837.5
3.	Other revenues (reimbursement)	17,632.8	0.0	0.0	0.0	0.0
II	**Total expenditures (1+2)**	**51,355.1**	**60,088.1**	**51,355.1**	**61,345.1**	**51,355.1**
1.	Business expenditures	51,355.1	60,088.1	51,355.1	61,345.10	51,355.1
1.1.	Material costs	39,358.1	48,091.1	39,358.1	49,348.1	39,358.1

No.	Element	Year				
		I	II	III	IV	V
1.2.	Non-material costs without depreciation and interest	8,132.0	8,132.0	8,132.0	8,132.0	8,132.0
1.3.	Depreciation	3,865.0	3,865.0	3,865.0	3,865.0	3,865.0
2.	Financial expenditures	0.0	0.0	0.0	0.0	0.0
2.1.	Interest	0.0	0.0	0.0	0.0	0.0
III	**Gross profit (I-II)**	**20,515.2**	**18,074.4**	**2,882.4**	**12,947.4**	**2,882.4**
IV	**Income tax**	2,051.5	1,807.4	288.2	1,294.7	288.2
V	**Net profit (III-IV)**	**18,463.7**	**16,267.0**	**2,594.2**	**11,652.7**	**2,594.2**

Source: IAE, 2021.

As the investment is completely financed from the own resources, there is no farm obligations to creditors, so basically forming of economic flow (Table 13.) does not include the interest. Although there is certain level of oscillations in gained values of net cash flow, they are positive during the complete period. Derived net cash flow in second production model has slightly higher values, what is primarily caused by more pronounced gap between the income sides of the observed models. Development of economic flow enables later realisation of investment analysis, i.e. calculation of static and dynamic indicators (Tables 14-19.).

Table 13. Forming of economic flow in both (25 ha and 30 ha) crop production models (in EUR)

no	Element	Initial moment	Year				
			I	II	III	IV	V
Crop production – I model (25 ha)							
I	**Cash inflow (1+2)**	**0.0**	**62,970.3**	**65,275.0**	**45,337.5**	**62,050.0**	**68,527.5**
1.	Total revenues	0.0	62,970.3	65,275.0	45,337.5	62,050.0	45,337.5
2.	Salvage value	0.0	0.0	0.0	0.0	0.0	23,190.0
	2.1. Fixed assets	0.0	-	-	-	-	19,325.0
	2.2. PWC	0.0	-	-	-	-	3,865.0
II	**Cash outflow (3+4+5)**	**42,515.0**	**40,697.7**	**47,477.9**	**38,934.4**	**48,098.2**	**38,934.4**
3.	Investment value	42,515.0	-	-	-	-	-
	3.1. In fixed assets	38,650.0	-	-	-	-	-
	3.2. In PWC	3,865.0	-	-	-	-	-
4.	Costs without depreciation and interest	0.0	38,652.4	45,929.9	38,652.4	46,977.4	38,652.4
5.	Income tax	0.0	2,045.3	1,548.0	282.0	1,120.8	282.0
III	**Net cash flow (I-II)**	**-42,515.0**	**22,272.6**	**17,797.1**	**6,403.1**	**13,951.8**	**29,593.1**
Crop production – II model (30 ha)							
I	**Cash inflow (1+2)**	**0.0**	**71,870.3**	**78,162.5**	**54,237.5**	**74,292.5**	**77,427.5**
1.	Total revenues	0.0	71,870.3	78,162.5	54,237.5	74,292.5	54,237.5
2.	Salvage value	0.0	0.0	0.0	0.0	0.0	23,190.0
	2.1. Fixed assets	0.0	-	-	-	-	19,325.0
	2.2. PWC	0.0	-	-	-	-	3,865.0
II	**Cash outflow (3+4+5)**	**42,515.0**	**49,541.6**	**58,030.5**	**47,778.3**	**58,774.8**	**47,778.3**

no	Element	Initial moment	Year				
			I	II	III	IV	V
3.	Investment value	42,515.0	-	-	-	-	-
	3.1. In fixed assets	38,650.0	-	-	-	-	-
	3.2. In PWC	3,865.0	-	-	-	-	-
4.	Costs without depreciation and interest	0.0	47,490.1	56,223.1	47,490.1	57,480.1	47,490.1
5.	Income tax	0.0	2,051.5	1,807.4	288.2	1,294.7	288.2
III	**Net cash flow (I-II)**	**-42,515.0**	**22,328.7**	**20,132.0**	**6,459.2**	**15,517.7**	**29,649.2**

Source: IAE, 2021.

Static indicators of investment evaluation

As was previously defined, by one part investment analysis involves calculation of static indicators, i.e. Total Output-Total Input Ratio, Net Profit Margin, Accounting Rate of Return, and Simple Payback Period. In practice, investment alternatives are assessing related to the value of indicators in all or pre-defined representative year of investment usage (Subić, 2010).

a) Total Output-Total Input Ratio (Ee)

This indicator e is applied to describe the overall productivity of used inputs (Furniss, 1964) after the irrigation system is implemented at the farm. Success of farm activities are driven both by market "generosity", i.e. by the general need for certain agri-food product and its current price, as well as by derived costs linked to practicing the selected production line (Oosterhaven, 1988). The main goal of farm manager is to favour as many as possible production lines with suitable value of mentioned ratio, i.e. to try to maximize the value of the ratio in each specific production line practiced at the farm (Ruttan, 1957). Unfortunately, for farm is so hard to control the income side of business, as it is usually the direct reflection of market stability, but it could control well the incurred costs in production cycles. So, related to pairing the values of gained output and overall costs, farm could find in two situations, reporting the gross profit or loss (Sen, 1962).

At observed farm, investing the money is economically acceptable in both models (Table 14.), as the value of the Total Output-Total Input Ratio overcomes the one (Ee>1) in all years of irrigation system exploitation. In average, ratio takes the value of 1.13, or 1.12, as related to selected crop rotation it shows certain annual oscillations. It should be mentioned that its value will be somewhat higher after adding the subsidies to income.

Table 14. Total Output - Total Input Ratio in both (25 ha and 30 ha) crop production models (in EUR), (economically justified Ee > 1)

Year	Total output (realised production)	Total input (production costs)	Ee
0	**1**	**2**	**3 = 1/2**
Crop production – I model (25 ha)			
I	44,500.0	42,517.4	1.05
II	64,437.5	49,794.9	1.29
III	44,500.0	42,517.4	1.05
IV	61,212.5	50,842.4	1.20
V	44,500.0	42,517.4	1.05
Crop production – II model (30 ha)			
I	53,400.0	51,355.1	1.04
II	77,325.0	60,088.1	1.29
III	53,400.0	51,355.1	1.04
IV	73,455.0	61,345.1	1.20
V	53,400.0	51,355.1	1.04

Source: IAE, 2021.

b) Net Profit Margin

Indicator represents the ratio between the net profit (earnings after tax) and realised production (sales revenues) gained in observed period at certain farm (Mishra et al., 2012; Yuliani & Anggaradana, 2021). Considering the investment economically justified requires that indicator (NPMR) gains the values higher than the active calculative interest rate in all specified years of investment usage (Subić et al., 2020).

In both models (Table 15.), investment could be assumed justified, as the indicator has values over the predefined interest rate (i = 4%) in all years. It is notable that the value of indicator is being eroded in certain years, what is primarily the consequence of accepted model of crop-rotation (existence of single or double cropping). In average, the NPMR takes the value of 18.17, or 16.24. Gained indicator's value for both models, slightly favour the first production model, what is primarily caused by the existence of the costs of rent (almost 2% of overall costs) and lower sum of production subsidies in second model.

Table 15. Net profit margin ratio in both (25 ha and 30 ha) crop production models (in EUR), (economically justified NPMR > i)

Year	Net profit	Total output (realised production)	NPMR
0	**1**	**2**	**3 = 1/2*100**
Crop production – I model (25 ha)			
I	18,407.61	44,500.00	41.37
II	13,932.09	64,437.50	21.62
III	2,538.09	44,500.00	5.70
IV	10,086.84	61,212.50	16.48

Year	Net profit	Total output (realised production)	NPMR
0	**1**	**2**	**3 = 1/2*100**
V	2,538.09	44,500.00	5.70
Crop production – II model (30 ha)			
I	18,463.68	53,400.00	34.58
II	16,266.96	77,325.00	21.04
III	2,594.16	53,400.00	4.86
IV	11,652.66	73,455.00	15.86
V	2,594.16	53,400.00	4.86

Source: IAE, 2021.

c) Accounting Rate of Return

This indicator measures the ratio between the gained net profit and invested sum into the used investment object. Investment will serve as good solution for the farm if gained value of indicator (ARR) is above the defined calculative interest rate in certain period. Even more, use of investment will be considered more attractive for the farm by increasing the difference between the indicator and interest rate (Whittington, 1979; Penman, 1991). As with previous indicator investment in irrigation system seems to be justified in both models (Table 16.), as ARR overcomes the calculative interest rate (i = 4%) in all observed years. Again, sharp fall in ARR in certain years is caused by applied crop-rotation. Related to average values of ARR (22.35, or 24.26), investment is better fitting the second model.

Table 16. Accounting Rate of Return ratio in both (25 ha and 30 ha) crop production models (in EUR), (economically justified ARR > i)

Year	Net profit	Initial outlay	ARR
0	**1**	**2**	**3 = 1/2*100**
Crop production – I model (25 ha)			
I	18,407.61	42,515.00	43.30
II	13,932.09	42,515.00	32.77
III	2,538.09	42,515.00	5.97
IV	10,086.84	42,515.00	23.73
V	2,538.09	42,515.00	5.97
Crop production – II model (30 ha)			
I	18,463.68	42,515.00	43.43
II	16,266.96	42,515.00	38.26
III	2,594.16	42,515.00	6.10
IV	11,652.66	42,515.00	27.41
V	2,594.16	42,515.00	6.10

Source: IAE, 2021.

d) Simple Payback Period

Assuming the equal annual cash flows in certain period of investment usage, indicator confronts the invested value with net cash flow (NCF) derived in representative year. It

defines the period required for returning the invested assets from the accumulated net cash flows (CNFC), (Subić, 2010; Jeločnik & Subić, 2020). So, in case that the value of net profit is significantly oscillating within the observed period, indicator assumes direct calculation of years needed for investment repayment from the cumulative (overall) revenues (Loginovskiy, 2016).

In line to presented in Table 17., investment will be repaid from farm business in 2 years and 4.56 months at model I, or in 2 years and 0.12 months at model II. In these circumstances, both models could be considered economically justified, as the period needed for covering the initial outlay is relatively short, i.e. shorter than usual period of credit expiration for that purposes at national level. Besides, indicator slightly favours the second model.

Table 17. Simple payback period in both (25 ha and 30 ha) crop farming models (in EUR), (SPP < n)

Year	NCF	CNCF
Crop production – I model (25 ha)		
0	-42,515.00	-42,515.00
I	22,272.61	-20,242.39
II	17,797.09	-2,445.30
III	6,403.09	3,957.79
IV	13,951.84	17,909.63
V	29,593.09	47,502.72
Crop production – II model (30 ha)		
0	-42,515.00	-42,515.00
I	22,328.68	-20,186.32
II	20,131.96	-54.36
III	6,459.16	6,404.80
IV	15,517.66	21,922.46
V	29,649.16	51,571.62

Source: IAE, 2021.

Dynamic indicators of investment evaluation

In second part, economic analysis of irrigation system implementation includes development of dynamic indicators, i.e. Net Present Value, Internal Rate of Return and Dynamic Payback Period.

Compared to static, dynamic approach in investment analysis is adjusted to the time preference of money, i.e. it considers the time value of money. So, all net cash flows linked to the realisation of certain investment, developed throughout the overall time period of investment usage, will be usually set (discounted) to the current moment and current values (Subić et al., 2017b).

a) Net Present Value (NPV) and Internal Rate of Return (IRR)

Basically, net present value (NPV) shows the cumulative distinction between the present values of cash inflows and outflows gained within the complete economic flow of certain investment realization and use. In line to used calculative rate of interest, i.e. minimally expected yield of profit, NPV points out to level of growth in assets caused by investment use during its lifetime (Juhász, 2011). Gaining the positive value of NPV assumes that incomes derived during the investment usage exceed the overall costs of the investment implementation (Götze et al., 2008).

Simultaneously, internal rate of return (IRR) assess the level of profitability of certain investment alternative. It represents the discount rate that equals the NPV of certain project to zero. This is an annual rate of return that could be achieved through the investment realisation (Kelleher & MacCormack, 2005). Some general rule says that investment will be accepted only if IRR is above the cost of capital (current interest rate at the financial market), or while ranking the investment alternatives those with the highest IRR will be financed (Magni, 2010).

In both models farm could expect the growth in profit (in line to discount rate of i = 4%) derived from the investment use in next five years, or it could achieve the value of NPV (Table 18.) of 37,297.16 EUR (model I) and 40,944.19 EUR (model II). In same time, gained values for IRR define the use of investment in both models of production as fully profitable for the farmer, i.e. in both production models IRR significantly surpass (31.14% or 33.63%) the predefined calculative interest rate (4%). According to gained values for NVP and IRR, implementation of investment better fits the second model of production.

Table 18. NPV and IRR in both (25 ha and 30 ha) crop production models (in EUR)

no.	Element	Initial moment	Year					Cumulative
			I	II	III	IV	V	
0	1	2	3	4	5	6	7	8
	Crop production – I model (25 ha)							
1.	NCF from economic flow (3 to 7)	-42,515.00	22,272.61	17,797.09	6,403.09	13,951.84	29,593.09	***90,017.72***
2.	Discount rate (i, in %)	4.00	4.00	4.00	4.00	4.00	4.00	
3.	Discount factor	1.0000	0.9615	0.9246	0.8890	0.8548	0.8219	
4.	Present value of NCF from economic flow (3 to 7)	-42,515.00	21,415.97	16,454.41	5,692.32	11,926.09	24,323.36	***79,812.16***
5.	**NPV of investment (2 to 7)**	**37,297.16**						
6.	**Relative NPV of investment [(2 to 7) /	col. 2|*100 > i**	**0.88**					
7.	**Internal rate of return (IRR > i)**	**31.14%**						
	Crop production – II model (30 ha)							
1.	NCF from economic flow (3 to 7)	-42,515.00	22,328.68	20,131.96	6,459.16	15,517.66	29,649.16	***94,086.62***
2.	Discount rate (i, in %)	4.00	4.00	4.00	4.00	4.00	4.00	
3.	Discount factor	1.0000	0.9615	0.9246	0.8890	0.8548	0.8219	
4.	Present value of NCF from economic flow (3 to 7)	-42,515.00	21,469.88	18,613.13	5,742.17	13,264.56	24,369.45	***83,459.19***
5.	**NPV of investment (2 to 7)**	**40,944.19**						
6.	**Relative NPV of investment [(2 to 7) /	col. 2|*100 > i**	**0.96**					
7.	**Internal rate of return (IRR > i)**	**33.63%**						

Source: IAE, 2021.

b) Dynamic Payback Period

This indicator defines the period needed for repaying the previously invested assets from the discounted net cash flows derived from the investment object use (Bhandari, 2009).

Table 19. Dynamic payback period in both (25 ha and 30 ha) crop production models (in EUR), (DPP < n)

Year	Present value of NCF	CNCF
Crop production – I model (25 ha)		
0	-42,515.00	-42,515.00
I	21,415.97	-21,099.03
II	16,454.41	-4,644.62
III	5,692.32	1,047.70
IV	11,926.09	12,973.80
V	24,323.36	37,297.16
Crop production – II model (30 ha)		
0	-42,515.00	-42,515.00
I	21,469.88	-21,045.12
II	18,613.13	-2,431.99
III	5,742.17	3,310.18
IV	13,264.56	16,574.74
V	24,369.45	40,944.19

Source: IAE, 2021.

Observing the value of the indicator for both models (Table 19.), it could be noticed that investment will be returned in relatively short period. Specifically, for model I farmer could expect repayment of invested assets in 2 years and 9.84 months, while in case of model II needed time is 2 years and 5.04 months. Related to this indicator, investment in both models is economically justified, while second model is slightly favoured.

In line to gained values for indicators of static and dynamic investment analysis, generally both models could be considered economically justified. Besides, farm have to strive to realize investment linked to second model, as investment reacts well to spreading of production surfaces. Even more, all indicators in second model will be much better if there are no costs of renting.

It will be also interesting to reconsider economic justification of investment if farm does not apply for reimbursement of part of invested assets, or if calculative interest rate increase on 6%, related to potential business risks towards the occurrence of economic crisis.

According to the value of dynamic indicators, in case when farm is not supported by public subsidies, it will be still worthy to invest in both models (model I: NPV - 22,038.01 EUR; IRR - 17.76%; DPP - 4 years and 1.08 months, or model II: NPV - 25,685.04 EUR; IRR - 19.99%; DPP - 3 years and 10.81 months).

In same time, in case when calculative interest rate increase on 6%, it will be also economically justified to farm to invest in both models (model I: NPV - 32,877.24 EUR; IRR - 31.14%; DPP - 3 years and 0.36 months, or model II: NPV - 36,337.42 EUR; IRR - 33.63%; DPP - 2 years and 7.8 months), while investment seems to be more sensitive on lack of public support.

Conclusion

Pressure of climate change to ensuring the stability in crop production in Serbia is mainly expressed through the decrease in rainfalls or shift in their patterns, as in appearance of frequent heatwaves and semi-intensive to hard droughts. Meanwhile, although the implementation of irrigation systems is publically supported, this agro-technic measure is not often present on small farms active in crop production.

Although there are not universal agro-technique solutions or unique receipt for crop farms, we assume that the bottom-line that guarantees the market orientation and sustainability to family farms is between 25 to 30 ha of used land surfaces, including the irrigation. As adequate alternative for irrigation at "small" size crop farms could be Tifon irrigation system.

Results derived from assessment of economic effects linked to investment in implementation of irrigation system at two size farm modalities (crop farming at 25 ha and 30 ha) partially covered by public support show that in both modalities under assumed production circumstances investment could serve (NPV from 37.3 to 40.9 thousands EUR, IRR from 31.1% to 33.6%, or DPP from 2 years and almost 10 months to 2 years and 5 months) as instrument that will surely boosts the farm business sustainability. It is proved that increase in irrigated agricultural surfaces could cause better economic effects, while farm could also hold out the observed investment in irrigation system without public support or under the increased interest rate.

Some further steps could be recognized in determining the minimal surfaces under the crops (including the optimal crop structure, crop rotation or crop production intensity) that makes investment in implementation of the Tifon irrigation system economically justified for farmer.

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Conflict of interests

The authors declare no conflict of interest.

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CONSUMERS' INTENTION TO BUY CHEESES WITH GEOGRAPHICAL INDICATIONS: THE CASE OF SERBIA

Dubravka Užar[1], Dušan Dunđerski[2], Vladimir Pejanović[3]

**Corresponding author E-mail: dubravkauzar@gmail.com*

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ABSTRACT

In recent years, GI cheese consumption has attracted increasing interest among consumers, due to its beneficial properties for local economies and the surrounding environment. Given the high importance that consumers ascribe to geographical indications, considered one of the most relevant attributes for agro-food consumers, this study aims at detecting the main variables that influence purchasing intention for GI cheese. A total of 806 consumers took part in the study from all four regions of the Republic of Serbia. For this purpose, a binary logistic regression model analysis was performed. The research highlights that tradition and origin, education, and higher knowledge only had a significant effect on consumer attitudes toward GI cheeses.

Introduction

Consumption of traditionally produced food has received significant attention in the food purchasing domain over the last decade. Today there is an increasing number of consumers who want to purchase and use in their diet indigenous products produced in small quantities according to the ecological norms of the EU. Consumer desire for preferably innovative, high-quality, health-guaranteed products is causing the agri-food industry to evolve in order to meet these demands and compete in the marketplace (Tendero & Bernabeu, 2005).

Studies based on the significance consumers attach to Geographical Indications (GIs), such as "Protected Designation of Origin" (PDO) and "Protected Geographical

1 Dubravka Užar, MAgrEC, Teaching Assistant, University of Novi Sad, Faculty of Agriculture, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia, E-mail: dubravka.uzar@polj.uns.ac.rs, ORCID ID (http://orcid.org/0000-0002-0593-7383)

2 Dušan Dunđerski, MSc, PhD student, University of Novi Sad, Faculty of Agriculture, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia, E-mail: dundjerskid@gmail.com, ORCID ID (http://orcid.org/0000-0002-0094-033X)

3 Vladimir Pejanović, MEM, IT sector engineer, University of Novi Sad, Faculty of Technical Sciences, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia, E-mail: vladimirpejanovic@uns.ac.rs

Indication" (PGI) labels, have been rather scarcely or infrequently explored, despite recent research efforts to analyze the role of geographical origin in consumers' choices of cheese from various markets (Menozzi et al., 2021). A Protected Designation of Origin (PDO) label is "applied to agricultural products and foodstuffs that are produced, processed, and prepared in a defined geographical area, a specific place, or a country, and whose quality or characteristics are primarily or exclusively due to that geographical environment's inherent natural and human factors" (EU Regulation 510/2006). Contrarily, agricultural goods and foodstuffs that are strongly connected to a particular geographic region are those that have the Protected Geographical Indication (PGI) label. In the region, at least one stage of production, processing, or preparation takes place (EU Regulation 510/2006). Third, the Traditional Specialty Guaranteed (TSG) label signifies "food that recognizes tradition but is not linked to any particular region" (Ferrer-Pérez et al., 2020). The European Commission's study from 2020 states that PDOs and PGIs help to maintain the variety of native plants, promote tourism, and promote rural regeneration (Likoudis et al., 2015). The goal of European origin protection is to prevent misleading geographical source indications and to protect regionally anchored products and production methods from "reputation exploitation, imitation, and deception." (Chilla et al., 2021). The labeling scheme is recognized as a key foundation for sustainable rural development because of its capacity to provide significant additional value in less accessible and distant locations like oasis and mountainous regions (Arfini et al., 2019). Furthermore, PDO/PGI certification of specific area foodstuffs could offset the negative effects of globalization and possibly present a significant economic opportunity (especially in underdeveloped and remote areas), allowing for product differentiation according to different areas and thereby promoting the growth of these areas (Likoudis et al., 2015). A label is meant to aid consumers in distinguishing the food from other goods that are similar to it and assist them make better decisions based on their preferences (Vecchio & Annunziata, 2011).

Autochthonous cheeses are milk products are created in a certain geographical region as a result of the long-term development of traditional production (Ostojić & Topisirović, 2006; Savić & Đurić, 2008). Each of these cheeses has a rich history and represents a potential lever for engaging local human and material resources and improving lives in the communities where they are produced (Užar et al., 2019). Consumers in our country are aware of the importance of nutrition and its impact on health, so new demands are increasingly being created for products with added value, among which cheese plays an important role (Popović et al., 2017). The importance of the production of cheeses with a geographical indication is also reflected in their contribution to developed countries. Customers who buy Parmigiano Reggiano PDO cheese from a nearby dairy store support advantageous externalities at the local level, such as the maintenance of local agriculture and, consequently, the stabilization of nearby rural towns (Mancini et al., 2019). The case of PDO Comté cheese in France illustrates how a PDO certification can generate public recognition of a product's quality, enabling rural producers' incomes to increase and contribute to rural development (Gerz & Dupont, 2006).

Studies examining the variables influencing consumer intention regarding food with GIs are rare in Serbia, since there is no tradition of utilizing EU quality labels, despite the growing professional interest in and literature on consumer preferences for EU quality labels. Therefore, the goal of the current study was to find out what influences Serbian customers' decision to purchase cheeses with GIs. Promoting specially labeled agri-foodstuffs requires an understanding of the key variables that affect consumers' purchasing decisions for GI cheeses (Likoudis et al., 2015). The primary goal of the current study was to determine how customer traits, attributes, and knowledge affected their desire to buy cheeses with GI. By offering a methodology to evaluate the effects of customers' perceptions and characteristics on purchasing intention of GI products, this article adds to the collection of existing marketing literature on consumer research.

The first section of this article provides a brief summary of the literature that has already been addressed about the key variables affecting consumer behavior with regard to GI goods. The second section describes the process for acquiring data and consumer recruitment, as well as the logistic regression that was used. The key findings are presented and discussed in the third section, and the main implications and limitations of our study are discussed in the conclusion.

Literature review

Previous research has focused primarily on the impact of intrinsic characteristics on consumer acceptance. Consumers' desire to buy and readiness to pay for the protected PDO/PGI product are significantly influenced by their interest in the origin of foods, how well the product is marked with a PDO/PGI label, and their perception that a PDO/PGI label indicates higher quality (Van Der Lans et al., 2001). Studies confirm that consumers are interested in the specific location, techniques used for production, ingredients used, processing methods and individual sensory characteristics of the product (de-Magistris & Lopéz-Galán, 2016; Dias & Mendes, 2018). In their 2005 survey of Spanish cheese buyers, Tendero and Bernabeu came to the conclusion that in order to ensure quality and safety, the place of origin is more significant than other factors (such as the type of cheese). Among Italian consumers, results demonstrated that Italian origin was one of the most important factors most highly rated by the respondents (Vecchio & Annunziata, 2011). Additionally, research by Teuber (2011) shows that consumers who value the origin of products are most often ready to support the local economy and purchase GI products.

Previous research have paid a lot of attention to the impact of consumer acceptance of intrinsic traits. According to Teuber (2011), the perceived higher quality of PDO/PGI products compared to unprotected products is the most important element that affects their success in the market. The results obtained within the study of Fandos and Flavian, (2006) revealed that the perceived quality associated with the internal attributes of a traditional food product (taste, flavor, texture, naturality, etc.) clearly has a positive and significant impact on consumer purchase intentions. Consumers perceive local foods to be fresher in terms of food quality because they are grown close to

consumers and distributed over a shorter transport distance (Arsil et al., 2014) which represents a significant determinant of quality.

In marketing literature, functional characteristics were found to be determinants of actual purchase in the cheese sector (de Souza Monteiro & Lucas, 2001). Tregear and Ness (2005) indicate that extrinsic (environmental impact, welfare and origin) and functional characteristics of food (price, appearance, packaging) are important determinants in consumers' consideration of purchasing GI food. Respondents also choose to consume traditional products because they find functional characteristics linked to the appearance and brand (Pieniak et al., 2009). Consumers who attach importance to packaging and labels are more inclined to better evaluate the benefits of the product. Previous research on packaging characteristics (Becker et al., 2011) revealed that visual design parameters such as the color and shape of the packaging affect consumer perceptions and expectations.

In more recent research, consumer perception studies specifically investigated whether cheese has any positive health effects (Vujanić et al., 2021; Di Vita et al., 2021). An analysis conducted in a study by Voinea et al., (2020) revealed that the attributes "healthy" and "convenience" are the main characteristics of traditional foods that guide the consumption decision of respondents. De Magistris and López-Galan (2016) point out that motives related to personal health, well-being, and quality of life, including "naturalness" in production, as well as a particularly observed absence of agrochemical use influence consumers' willingness to pay a higher price for cheese. This data results in the fact that consumers are primarily interested in their own health and that it represents the main motive for consuming food prepared from traditional ingredients according to a traditional recipe.

It is commonly known that consumer product knowledge has a significant impact on how they behave as buyers (Likoudis et al., 2015). The level of product knowledge is a significant factor influencing the level of information searches (Pillai & Hofacker, 2007). Despite the fact that PDO/PGI products are more prevalent and easily accessible to consumers now than ever before, there is evidence that consumers lack clarity and awareness regarding their definition and attributes. Previous literature shows there are also indications that Greek consumers lack of information about certified product labels, which seems to influence their lower purchasing intentions (Fotopoulos & Krystallis, 2003). More specifically, in a study by Aprile et al., (2008) consumers were not always able to identify the products with the European designation of origin and the ones without, although the products fall within the regular purchase and consumption choices. Additionally, Stojanovic et al. (2013) discovered that consumers' frequency of consumption of traditional foods was positively influenced by their level of knowledge.

A qualitative method revealed the relationship between cheese consumption and a few socioeconomic factors, including gender, age, education level, family size, and income. In instance, a higher income and older age cohort are positively connected with cheese intake (Fotopoulus & Krystallis, 2003). According to Goudis and Skuras (2020) as the

educational level of the respondent increases, the odds that the consumer is PDO logo aware increase significantly, therefore and their intention to purchase PDO labeled food. In the line with this study, Grunert and Aachmann (2016) examine studies that show that consumers of average or older age prefer PDO-labeled products. The importance of education as a consumer characteristic also indicated that highly educated respondents tend to buy locally produced food (Skubic et al., 2018). In addition, the findings of Stojanovic et al. (2013) discovered that consumers with higher income levels purchase more labeled food. A higher WTP for PDO cheese is favorably connected with female gender, high wealth, and education levels, according to de-Magistris & Lopéz-Galán (2016). Additionally, earlier research suggested that consumers' household sizes were important sociodemographic factors that affected their acceptance of traditional foods. For instance, Goudis and Skuras (2020) discovered that households with smaller sizes were more likely to purchase functional foods than those with bigger sizes.

The purpose of this study was to investigate into the factors that contribute to Serbian consumers' intention to purchase GI cheeses. Understanding the primary elements influencing customers' purchasing intentions for GI cheeses is a critical step toward promoting special labelled agri-foodstuffs.

Methodology

In order to identify the key factors influencing the consumption of GI cheese, a convenience sample of consumers in Serbia was used in the survey. Despite the fact that the study's representativeness is limited by the use of this non-probabilistic sampling approach, it was decided to utilize it nonetheless due to the validity of the data, which is supported by the frequent usage of this sampling technique for consumer surveys (Di Vita et al., 2021).

A number of sections made up the questionnaire. The demographic details of the sample, including gender, age, education level, annual family income, and the number of household members, were included in the first part. On a 5-point Likert scale (1-5 not at all important, 2-5 low important, 3-5 moderately important, 4-5 very important, 5-5 extremely important), respondents were also asked to rate the significance of various selection criteria (factors) that they considered when making a purchasing decision, such as taste, flavor, color, price, appearance, packaging, brand name, origin, health, nutritional value, traditional production, freshness, and manufacturer knowledge. Consumers' knowledge was measured on several statements (Label is a quality guarantee; label is a guarantee of tradition and method of production, the label is a guarantee of the country of origin, the label is a guarantee of the place of production) on a 5-point Likert scale (1-I totally disagree, 5-I totally agree). Finally, the intention to buy GI products was directly assessed by the following statement: "I intend to purchase GI cheeses in the next 6 months" (1-I totally disagree, 5-I totally agree).

Twenty people participated in a pilot survey to test the questionnaire, which was then verified. We gathered a total of 806 completed questionnaires at the conclusion of

the interviews before we processed the data. Table 1 reports the socio-demographic characteristics of the sample. The majority of respondents (18.5%) are aged 25 to 34, and the gender distribution shows a somewhat higher frequency of females (60.3%) than males (39.1%) and respondents who are unable to self-identify (0.6%). Additionally, the "Four Years High School Diploma" (37.6%) is the most prevalent educational level, followed by the graduate level (33.5%). Additionally, we noted that "766-1020 €" (20.1%) is the monthly salary range with the highest prevalence. About 49.3% of survey participants live in households with three or more people.

Table 1. The structure of the sample

		%			%
Gender	Female	60.3	*Household size*	1 - 2	28.5
	Male	39.1		3 - 4	49.3
	I cannot identify myself	0.6		5 or more	22.2
Age	18-24 years	10.3	*Income (EUR)*	< 255	8.2
	25-34 years	18.5		256-425	17.7
	35-44 years	18.4		426-595	15.8
	45-55 years	21.5		596-765	18.7
	56-65 years	13.8		766-1020	20.1
	Over > 65 years	17.6		> 1021	19.5
Level of education	Unfinished primary school	1.1			
	Primary school	4.2			
	Three years high-school diploma	7.1			
	Four years high-school diploma	37.6			
	Bachelor's degree or equivalent level	33.5			
	Master, Postgraduate, or doctoral degree	16.5			
Note: n=806					

Source: Authors' calculation

Data were analyzed using descriptive statistics. Exploratory Factor Analysis (EFA), which identifies the underlying latent components derived from observed variables, was performed to explore the structure of our data utilizing 18 attributes. Bartlett's Test of Sphericity and the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy were also employed to check for deviations from statistical presumptions. Both of these methods determine whether the dataset of interest contains enough big associations to execute EFA. Value KMO measure of sampling adequacy higher of 0.60 and insignificant Bartlett's test it is an indicator that latent factors may be present and EFA may be performed (Dziuban & Shirkey, 1974). The internal consistency of each of the factors within the scale was assessed using Cronbach's coefficient alpha. All yielded suitable answers over the 0.70 level advised by author DeVellis and & Thorpe (2021).

In order to determine the key variables that are linked to respondents' intentions to purchase cheese with geographic indications, binary logistic regression analysis was lastly carried out. The dependent variable is a latent variable that has a value of one (1) when a respondent plans to buy GI cheeses and null (0) in all other circumstances (Likoudis et

al., 2015). Independent variables included in the regression were factors obtained from EFA and socio-demographic characteristics: gender, age, level of education, household size and income. The sum of the following four binary variables was used to create a quantitative variable that represented the respondent's geographic knowledge of cheese: (Label is quality guarantee; label is guarantee of tradition and method of production, label is guarantee of country of origin, label is guarantee of place of production). Factors obtained from EFA and a quantitative variable were set as continuous variables, and socio-demographic characteristics were set as categorical variables. The goodness of fit of the logit model was assessed by Omnibus test of model coefficients and Hosmer and Lemeshow Test. Probability was calculated as ExpB/(ExpB+1). Reference category for gender - I don't want to make a statement; for age - over 65y; for education - finished Master, Postgraduate, or doctoral studies; for household size - over 5 members; for income - over 1022 EUR. Data were analyzed using the Statistical Package for the Social Sciences (IBM SPSS Statistics 21.0) software.

Results and discussion

Prior to estimating the binary logit model, an explorative factor analysis (EFA) was used to reduce the numerous variables into a small number of independent factors that could be included in the model. A four-factor solution was developed, with the five components explaining 58.45% of the overall variance. The factor model had a Kaiser-Meyer-Olkin Measure verify the sampling adequacy, with KMO = 0.895, which is above the acceptable limit. Bartlett's Test of Sphericity Approx. ChiSquare = 6776.615, p = 0.000, indicated that correlations between the items were sufficiently large. The variables with the highest factor loadings aided in the recognition and determination of the identity of the key factors. Table 2 explains the obtained four factors.

Table 2. Factor analysis on factors associated with respondents' purchasing intent

Factor (Cronbach α)	Factor interpretation (% variance explained)	Loading	Items
Tradition and origin	38.81%	,976	Region of origin
		,921	Country of origin
		,737	Geographical Indication
		,668	Knowledge of the producer
		,592	Traditional production
		,470	Brand‘s name
Intrinsic characteristics	10.45%	,893	Flavor
		,829	Quality
		,622	Freshness
		,587	Odor
Functional characteristics	5.52%	,731	Appearance
		,690	Color
		,562	Exterior appearance and packaging

Factor (Cronbach α)	Factor interpretation (% variance explained)	Loading	Items
Healthy and wholesome	3.66%	,855	Nutrition value
		,537	Naturality
		,534	Dairy fat content

Source: Authors' calculation

In order to evaluate the influence of personal characteristics, attributes and knowledge on the intention to purchase GI cheeses, the measurement model was evaluated by checking the overall model fit. The significance value of less than 0.05 for Omnibus Tests of Model Coefficients indicates that the current model outperforms the null model. Hosmer and Lemeshow Test goodness-of-fit test was not significant (p=0.908), which suggests a well-fitting model (table 3).

Table 3. Model goodness of fit

Cox & Snell R Square	Nagelkerke R Square	Hosmer and Lemeshow Test			Omnibus Tests of Model Coefficients		
		Chi-square	df.	Sig.	Chi-square	df.	Sig.
,116	,210	3,382	8	,908	99,746	26	,000

Source: Authors' calculation

In terms of consumer intentions, around 48.3% of the respondents said they planned to purchase GI cheeses in the upcoming six months. According to the results of binary logistic regression (Table 4), Tradition and Origin, Education, and knowledge significantly influenced consumers' intention to purchase GI cheese. In the survey, GI cheeses were more likely to be purchased by respondents who valued tradition and origin in their purchasing decisions. With every unit increase of implementation of this factor in promoting GI foods, the probability of consumers' intention to buy GI cheese increases by 63.35%, respectively. Our findings indicate that similar to other studies (Likoudis et al., 2016), the participants were more likely to consume PDO/PGI certified products if there were associated with origin and labeling and studies of Verbeke et al., (2012) who that traditions with origin played a significant part in how European consumers perceived and used EU labeling. Consumer ethnocentrism, or the preference for domestic over imported goods, may be used to explain why people generally prefer food products from their own nation or region. It is also important to note that, Serbian participants were aware that GI cheeses were of better quality compared with the conventional ones and guaranteed traditional production methods and country of origin.

Regarding socio-demographic characteristics, only education has a statistically significant influence on purchase intention. Consumers' intention to buy GI cheese differs statistically between those who didn't finish elementary school and those who finished their Master's, Postgraduate, or doctoral studies. The likelihood that a respondent will buy GI cheese considerably rises as their level of education does.

Probability of consumers' intention to buy cheese decreased by 9.31% for those who didn't finish elementary school compared with those with master's, postgraduate or doctoral degrees. In order to effectively search for, find, and retrieve information as well as perceive and comprehend knowledge, a consumer's level of education is essential (Goudis & Skuras, 2020). This result is in line with previous studies where socio-economic groups with a higher level of education scored better knowledge about nutrition and traditional products compared to socio-economic groups with a lower level of education (Sanchez-Villegas et al., 2003; Bogue et al., 2005).

In contrast to what was discovered in other studies on the consumption of common cheese (de-Magistris & Lopéz-Galán, 2016; Skubic et al., 2018), the other covariates related to socio-demographic characteristics—gender, age, income, and household size—do not seem to have a significant impact on consumers' GI attitudes. In this regard, Likoudis et al. (2016) used a logit model to evaluate Greek customers' propensity to purchase PDO products and discovered no correlation between willingness to purchase and socio-demographic traits. As a result, it appears that socio-demographic characteristics only partially explain customers' intent to purchase GI products.

Table 4. Results of binary logistic regression on intentions to buy GI cheeses

	B	S.E.	Wald	df	Sig.	Exp(B)	Probability
Tradition and origin	,547	,163	11,287	1	,001	1,728	63,35%
Intrinsic qualities	,080	,149	,290	1	,590	1,084	52,01%
Functional qualities	-,053	,172	,096	1	,757	,948	48,67%
Healthy and wholesome	-,264	,197	1,799	1	,180	,768	43,43%
Gender			2,343	2	,310		
Gender (man)	1,102	1,064	1,073	1	,300	3,011	75,07%
Gender (women)	1,333	1,060	1,581	1	,209	3,791	79,13%
Age			6,675	5	,246		
Age (18-24)	,230	,423	,295	1	,587	1,258	55,72%
Age (25-34)	,451	,380	1,403	1	,236	1,569	61,08%
Age (35-44)	,880	,404	4,748	1	,029	2,410	70,68%
Age (45-54)	,627	,369	2,886	1	,089	1,872	65,19%
Age (55-64)	,680	,411	2,736	1	,098	1,974	66,38%
Education			12,084	5	,034		
Education (unfinished elementary school)	-2,277	,855	7,087	1	,008	,103	9,31%
Education (finished elementary school)	-,236	,607	,151	1	,698	,790	44,14%
Education (finished 3y high school)	,242	,574	,177	1	,674	1,273	56,01%
Education (finished 4y high school)	-,107	,397	,072	1	,788	,899	47,34%

	B	S.E.	Wald	df	Sig.	Exp(B)	Probability
Education (finished college)	,398	,391	1,038	1	,308	1,489	59,82%
Household size			7,657	4	,105		
Household size (1 member)	1,096	,521	4,430	1	,035	2,994	74,96%
Household size (2 members)	-,223	,352	,402	1	,526	,800	44,44%
Household size (3 members)	,067	,357	,035	1	,852	1,069	51,67%
Household size (4 members)	-,178	,315	,320	1	,572	,837	45,56%
Income (EUR)			5,056	5	,409		
Income (255)	-,692	,447	2,396	1	,122	,501	33,37%
Income (256-426)	-,146	,393	,138	1	,711	,864	46,36%
Income (427-596)	,071	,412	,030	1	,862	1,074	51,79%
Income (597-767)	,277	,398	,483	1	,487	1,319	56,88%
Income (768-1022)	,059	,382	,024	1	,877	1,061	51,47%
Score_Knowledge	,489	,095	26,433	1	,000	1,630	61,98%
Constant	-1,486	1,214	1,498	1	,221	,226	

Source: Authors' calculation

Respondents who were knowledgeable of geographical indications and their benefits scored higher on the intention to buy GI cheeses. In this study, product knowledge clearly has a favorable impact on consumers' intentions to buy. The odds ratio indicates that with every unit increase in consumers' knowledge, the probability of consumers' intention to buy GI cheese increases by 61.98%. The study's findings are consistent with earlier research, which shows that product awareness positively influences consumers' intentions to buy PDO cheese (Cacciolatti et al., 2015).

Conclusion

This paper presents the preliminary results of a study on which factors attach importance to purchasing intention of GI cheeses. Tradition and origin, education, and knowledge were found to be strongly connected in the current study with Serbian consumers' intention to purchase GI cheeses. A crucial first step in promoting labeled agri-food products and supporting local sustainable development may be to recognize the key variables that impact consumers' purchasing intentions toward GI products.

In assessing the effect of certain specific personal characteristics, purchasing attributes and knowledge, the article has generated insights for producers and managers. Tradition and origin are the only factors influencing consumers' intention to buy cheeses with GI. It has been shown that consumers who place a high value on product quality perceive product origin as a significant quality determinant and a way to support local or regional (small) producers. Producers, in particular, should identify their products by labeling them with geographical indications, emphasizing the link between both the origin and the territory as a whole. Because this variable may significantly improve the likelihood

of purchase, the empirical setting of this study has brought attention to the significance of measuring the perceived origin image when building a marketing plan. It is essential that the schemes and standards are transparent enough to allow consumers to understand what they are purchasing. This suggests that producers should clearly highlight these attribute(s) adding value to the product and present their products, including their benefits and distinguishing characteristics. The product may appear to have a higher value to consumers as a result. The study shows that customers' prior product knowledge has a significant impact on their purchasing decisions for traditional cuisine. As a result, it is critical to provide appropriate and trustworthy information about GI in order to increase market demand, as such information may increase consumers' knowledge and attitudes toward GI cheeses. Also, the findings of this study suggest that the promotion of specialty foods should incorporate all of these factors.

By presenting the data of factors influencing customers' propensity to buy GI cheeses, this study makes a contribution to the existing literatures. However, this study has several drawbacks, like all empirical investigations. First, more analysis on comparable products from these and other categories should be done. Second, in further research, it is necessary to look at the statistically significant influence of mentioned factors on the actual purchase of products with GIs. Third, this study effectively lays the foundation for future research based on a larger and cross-national sample that can help to delve deeper into these initial findings, despite the use of a convenience sample representing a constraint and suggesting extending the considerations to a wider population with carefulness. Finally, given the substantial growth of GIs in agricultural landscapes, academic emphasis should be directed to examining the actions of farmers in the GI process since they should be leading the labeling initiative.

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Conflict of interests

The authors declare no conflict of interest.

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BUSINESS OF RURAL TOURIST HOUSEHOLDS IN THE FUNCTION OF RURAL TOURISM DEVELOPMENT IN SERBIA

Tatjana Bošković[1] Dejan Đurić[2], Bojana Kovačević Berleković[3], Dragana Đurić[4]

**Corresponding author E-mail: tatjanab44@gmail.com*

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ABSTRACT

The main goal of the paper is, based on research and analysis of the material base and tourist turnover of rural tourist households (RTHs), in the period from 2014 to 2019, to point out to the dynamics of development and the current level of development and utilization of the tourist offer of this sector in Serbia. Quantitative data on accommodation facilities in rural areas of the Republic of Serbia in six years period (2014-2019) are analyzed. In addition to research, various scientific methods were used: the inductive-deductive method, the method of analysis and synthesis and the method of observation. Based on the analysis of quantitative and qualitative aspects of supply it was concluded that a lack of international standards and quality guarantees was noticed, as well as problems related to adaptation, registration and categorization of the RTHs, which confirmed the basic research hypothesis.

Introduction

Today, tourism in rural areas has become a reality, need and desire of tourists, but also a carrier and instrument of rural development (Christou at al, 2018; Xue at al, 2017; Bălan, Burghelea, 2015). Tourism is one of the few activities that can contribute to the transformation of rural areas, uncultivated or empty space located between rural

1 Tatjana Bošković, Ph.D., Professor of Vocational Studies, Novi Sad School of Business, 4 VladimiraValtera Perića Street, 21000 Novi Sad, Phone: +381 21 485 4017, E-mail: tatjanab44@gmail.com, ORCID ID (https://orcid.org/0000-0002-5856-1527)

2 Dejan Đurić, Ph.D., Professor of Vocational Studies, Novi Sad School of Business, 4 VladimiraValtera Perića Street, 21000 Novi Sad, Phone: +381 63 805 7420, E-mail: ddjuric971@gmail.com, ORCID ID (https://orcid.org/0000-0002-0865-3765)

3 Bojana Kovačević Berleković, Ph.D., Professor of Vocational Studies, Novi Sad School of Business, 4 VladimiraValtera Perića Street, 21000 Novi Sad, Phone: +381 21 485 4016, E-mail: b.k.berlekovic@gmail.com ORCID ID (https://orcid.org/0000-0002-9135-3617)

4 Dragana Đurić, Ph.D., Professor of Vocational Studies, Academy of Vocational Studies Southern Serbia, 7 Partizanska Street, 16000 Leskovac, Phone: +381 65 805 7420, E-mail: djuricdragana387@gmail.com, ORCID ID (https://orcid.org/0000-0001-9787-0773)

settlements, into landscaped tourist areas suitable for the development of rural, farm, eco tourism, educational or excursion tourism (Pavlović, Kovačević Berleković, 2018). Well-developed and focused rural tourism can become a new source of money and jobs and at the same time it can eliminate social isolation and be an important factor in resettling the country.

Rapid urbanization, fast pace of life, changes in life habits and increasing periods of the day spent indoors and in front of the screen lead to the need for spending free time outdoors, in the fresh air. This affects the orientation of tourist movements from large cities to rural areas. Due to such tendencies, there are more and more justified studies dealing with the preservation of the environment of rural areas and the role and importance of the local communities in creating the tourist offer (Bošković, 2013; Byrd at al, 2009). In Europe more and more overnight stays are recorded in tourist accommodation capacities located in rural areas. Thus, for example, in the total number of overnight stays in 2014, rural areas participated with 36.1%, cities with 33.8% and cities and suburbs with 30.0% (Eurostat regional yearbook, 2017). The mentioned trend is explained by the growing need of people for staying and relaxing in nature, far from the city noise and the stressful way of life characteristic of urban environments. The current global health crisis (Covid-19), one of the biggest challenges for the tourism sector as a whole, has further strengthened the need for people to stay in smaller communities, away from crowds and big cities. Despite the strong impact of the pandemic on the tourism market and stopping tourist arrivals, a solution to revive tourism in some countries has been found in rural tourism (Cvijanović, at al, 2021). The results of the latest research (Covid-19 Survey Analysis Spring 2020), published by the European Rural Tourism Federation (EuroGites), indicate that in the future there will be greater interest in small enterprises, cottages and private houses without shared facilities than in large hotels. Also, quiet, not so well known and small destinations will be more attractive. People living in small flats in densely populated cities are increasingly appreciating landscape enjoyment, safe local food production and delivery, the potential of social separation, and accessible open public spaces, which were formerly undervalued (Lukić at al. 2022). A big chance for tourism in Serbia during the crisis might be in domestic rural tourism.

Rural development in Serbia has been defined as an economic, social, and environmental priority by the Government of Serbia. Rural Serbia represents a key part of the Serbian population and resources. The classification of rural and urban areas presents an important topic both in scientific research and in the practice of spatial planning, regional policy making, and territorial governance (Gajić at al, 2021). Serbia is a predominantly rural country. According to the OECD criteria, rural areas cover 85% of the total territory (and between 44% and 55% of the population lives in rural areas and an estimated 41% of GDP comes from rural areas (Law on the Spatial Plan of the Republic of Serbia 2010–2020). Rural areas in Serbia are very rich and diverse and represented by landscape diversity and cultural heritage.

In the Strategy of Agriculture and Rural Development of the Republic of Serbia for the period 2014-2024, one of the priorities within which the operational goals of the

Strategy are implemented is the diversification of the rural economy and the preservation of cultural and natural heritage, areas that are complementary to tourism (Strategy of Agriculture and Rural Development of the Republic of Serbia for the period 2014-2024).

The main goal of rural tourism in Serbia is to generate additional income of rural population, covering a range of tourism attractions, services and secondary activities provided by the rural population and private households (Strategy for the Development of Tourism of the Republic of Serbia, 2016 -2025). It is believed that rural tourism would contribute to accession of Serbia to the EU (Strategy for the Development of Tourism of the Republic of Serbia, 2016).

The rural areas in Serbia face depopulation, low job opportunities, very low diversification of economic activities, as well as other social problems. Because of all the above, it is concluded that, rural tourism is one of the very few economic opportunities that rural areas in Serbia have.

In this paper, the authors presented information on the level of services provided in RTHs in Serbia, and the aim was to point to the existing problems related to adaptation, registration and categorization of the RTHs as well as existing of regional imbalances in the level of services provided in the rural accommodation sector.

The main aim of the paper is to estimate the point to which legal and administrative procedures reached in recognizing new forms of accommodation in rural tourism in Serbia.

The paper analyzes the conditions for developing tourism in rural areas in Serbia from the aspect of receptive factors, especially rural tourist households. The topic of this paper is the accommodation capacities of rural tourist households (RTHs), which represent a significant segment in the development of tourism in rural areas of the Republic of Serbia. Research into rural tourism and RTHs can help the owners of the households involved in rural tourism to improve their offers. So far, only a small number of authors have pointed to this issue in Serbia, however, this research discusses problems related to adaptation, registration and categorization of the RTHs that have very negative implications for the development of rural tourism in Serbia.

Literature review

A large number of researches in the world deal with the development of rural tourism and the quality of services provided, which is often a limiting factor of development (Albacete-Saez at al, 2007; Christou et al, 2018; Xue at al, 2017; Forcan at al, 2016; Bălan, Burghelea, 2015; Antonsich, 2009; Byrd at al, 2009). Rural tourism is based on the principles of sustainability and involves a range of activities and services that people in rural areas are organized precisely on the basis of the elements that characterize rural areas. This implies that the visitor enjoys the authentic, original experiences and return to the roots and essence of rural life (Đorđević Milošević, Milovanović, 2012).

Tourism on a rural household or a farm or agritourism refers exclusively to a form of tourist service which is an additional activity on a farm with an "active" agricultural

activity, within which products produced on such a farm are offered (Baćac, 2011). This stance is also represented by the European Federation of Rural Tourism (EuroGites - the European Federation of Rural Tourism), according to which agritourism means only tourism on active farms. According to Kušen (2010), the name rural tourism today denotes three tourist phenomena: 1. Rural tourism - for tourism on farms, which is too broad; 2. Rural tourism - for all types of tourism that occur within the rural area, which is realistic; 3. Rural tourism - for all types of tourism that occur in the entire suburban area, which is too narrow. According to Pavlović (2015), rural tourist households are a form of rural tourism in which, in addition to agricultural production, households also provide additional services, i.e. they are engaged in tourism as a supplementary activity.

According to data from the European Federation of Rural Tourism (EuroGites) from 2017, the rural accommodation sector had more than 500,000 accommodation units and more than 5 to 6 and a half million of beds. The economic effects of this sector have been estimated at 900,000 direct or indirect jobs and more than one hundred and eighty million euros in revenues in rural areas. Rural tourist households (RTHs), due to their characteristic offer that is the very essence of a rural tourist product, can be one of the most important mainstays of tourism development in rural areas, but they can also contribute to the economic development of these areas.

Rural tourism in Serbia as well as in other European countries is a significant factor in multifunctional rural development, which is confirmed by numerous theoretical and empirical studies (Erdeji et al, 2013; Dimitrovski et al, 2012; Bošković at al, 2010; Todorović, Bjeljac, 2007; Ploeg, Renting 2000; Ploeg at al, 2000).

The Rural tourism in Serbia does not have a long tradition; 70s of the 20th century, can be considered the beginnings of the development of rural tourism (in the village of Seča Reka, Sirogojno and others (Todorović, Bjeljac, 2007; Todorović, Štetić, 2009). So, rural tourism in Serbia is a new phenomenon, in which, similarly to other regions of the world, agricultural workers and people living in rural areas are looking for some alternative sources of income (Fleischer, Felsenstein, 2000). In the last years of the 20th century, Serbia suffered a very difficult economic and political situation, so especially tourism in rural areas did not take a favorable position on the market. The regional constellation of Serbia is characterized by numerous diversity and a very heterogeneous degree of economic tourism development of rural areas (Gajić at al, 2018). Thanks to its natural, geographical, historical and other features, the Republic of Serbia has favorable conditions for the development of almost all types of tourism, including rural tourism (Đurić, Đurić, 2017). Wealth, maintained and attractive natural resources, a large number of traditional agricultural households, as well as the growing interest of the international tourism market for rural tourism experiences are pretty solid foundation for the development of rural tourism in Serbia, especially in its south-western and south-eastern part (Maksimović at al, 2015).

However, an enormous problem of accommodation capacities in rural areas and the major obstacle for rural tourism development is the categorization of establishments. Regulation in this branch is partially disordered (Penić, 2015). Therefore, there is the

need for law regulation in this area and precise definition of accommodation standards.

According to the results of a survey that included 58 RTHs in Vojvodina (Bošković, 2013), in 2011 most households stated a small number of guests as a problem in tourism, i.e. insufficient turnover, but also lack of capital, as well as problems related to adaptation, registration and categorization of the object. The largest number of surveyed subjects recorded up to 100 visitors/overnight stays per year, with dominating domestic demand. On the other hand, according to a survey of tourist organizations, about 77% believe that accommodation facilities are insufficient, about 18% believe that they are sufficient, but unsatisfactory. Only about 4.5% of respondents think they are enough. The research from 2012 indicated that, apart from the region of central Serbia, the level of accommodation quality and the concrete offer of rural tourism is at a low level (United Nations Environment Program (UNEP) and Young Researchers of Serbia). According to the research from 2015 (Gašić et al, 2015), in the period from 2005 to 2014, the average percentage of registered overnight stays in rural tourism in Serbia was around 21.21%. The lowest percentage was recorded in 2014 and amounted to 20.02%. Identifying the influence factors lie behind the livelihood choices of rural households are of crucial significance for improving the sustainable livelihoods of rural households in tourism regions (Huang at al, 2021).

Materials and methods

The method of observation, analysis and synthesis and inductive-deductive method were used in the paper. Quantitative data on accommodation facilities in rural areas of the Republic of Serbia in six years period (2014-2019) are analyzed. The sources of data are publications of the Statistical Office of the Republic of Serbia. The sources of information were the data of the Statistical Office of the Republic of Serbia, the Tourist Organization of Serbia (TOS), the Tourist Organization of Vojvodina (TOV) and the National Association "Rural Tourism of Serbia", the European Federation of Rural Tourism - EuroGites, as well as other relevant domestic and international institutions. Also, the paper will present the results of some previous and recent research in this field.

The basic hypothesis of the research is as follows:

H1: Rural tourism accommodation facilities play a key role in the advancement of rural product development but the problems and limitations of rural tourism development in Serbia related to adaptation, registration, utilization and categorization of the RTHs.

The hypothesis of this research is based on critical analysis relevant literary sources, both domestic and foreign authors, who have dealt with the topic of research on the quality of accommodation in rural areas (Huang at al, 2021; Bošković, 2013; Gajić at al, 2018; Christou at al, 2018; Xue at al, 2017; Garrod at al, 2006; Gašić et al, 2015).

Results and Discussion

In 2019, Serbia had a total of 50.110 rooms and 121.289 beds. In order to evaluate tourists' interest in rural areas of the Republic of Serbia, Table 1 provides information on

rural accommodation capacities in Serbia. According to the type of tourist places in 2019, accommodation capacities distributed in "other tourist places" had the most significant participation in the total number of rooms (rooms participated with 23.31%, and beds 22.94%). Accommodation capacities in the so-called "other tourist places" and "other places" can be connected with rural tourism (Radović, 2013, Gašić at al, 2015).

Table 1. Rural accommodation capacities - rooms, 2014-2019, the Republic of Serbia

Year	Number of rooms in all tourist places of RS	Number of rooms in rural areas (in "other tourist places" and "other places")	Participation in the total number of rooms
2014	43.603	14.544	33.36
2015	45.396	15.369	33.86
2016	46.362	15.224	32.84
2017	44.813	14.492	32.34
2018	48.190	15.381	31.92
2019	50.110	15.955	31.84

Source: Authors, based on the Statistical Yearbook of the Republic of Serbia, 2015, 2016, 2017, 2018, 2019, 2020

Rural accommodation capacities, shown through the number of rooms, for the entire presented period make up a little over 30% of the total number of rooms in all tourist places. Also, there is a slight decline in participation in the total number of rooms in the observed period, from 33.36% in 2014 to about 31.84% in 2019.

Table 2. Rural accommodation capacities - beds, 2014-2019, the Republic of Serbia

Year	Number of beds in all tourist places of RS	Number of beds in rural areas (in "other tourist places" and "other places")	Participation in the total number of rooms
2014	102.940	35.739	34.72
2015	106.102	37.207	35.07
2016	109.469	37.304	34.08
2017	106.029	35.570	33.55
2018	114.771	37.371	32.56
2019	121.289	39.287	32.39

Source: Authors, based on the Statistical Yearbook of the Republic of Serbia, 2015, 2016, 2017, 2018, 2019, 2020

Rural accommodation capacities measured by the number of beds make up a little over 30% of the total number of beds in all tourist places. The data also indicate a slight decline in the share of rural in the total number of beds. Rural accommodation includes various types and categories of accommodation in rural areas, which in the Republic of Serbia occupy 70-85% of the territory. "Rural accommodations uniquely differ from traditional hotels, motels, and boarding houses located in cities. Rural accommodations have their own characteristics and harmonize with their surroundings and local cultures" (Hyunsuk Choi et al, 2018, pp.2).

The development of tourism in rural households and farms has multiple significance, not only for tourism, but for the entire rural population and the economic development of rural areas. It can be said that the rural household is the basic "cell" of rural society and the activities it involves affect not only the household but also the entire community. The provision of tourist services by rural households produces numerous economic as well as non-economic effects.

Direct benefits are realized by members of households, by generating income from the provision of tourist services, but also from the sale of products from their domestic production. Tourism is a source of jobs and additional income for members of rural households, which is of particular importance for rural communities that lack the creation of so-called "new" jobs. The possibility of connecting with agriculture, which rural population is predominantly engaged in and supplementing low incomes from this activity is another significant advantage. Indirectly, the development of this type of tourism is reflected favorably on other rural households that can be involved in various ways, and above all, as suppliers of various products included in the food provision for tourists, but also in meeting their other needs for entertainment and amusement, education (introduction to rural affairs, local culture and tradition, customs, old crafts, local gastronomy ...) and the like. No less important are the so-called "non-economic" effects (demographic effects, cultural effects, infrastructure, environmental ...) which improve the living and working conditions of the population in rural areas, but also create conditions for attracting investment in these areas and their revival.

The current Hospitality Law recognizes different types of accommodation facilities, among which are rural tourist households. Rural tourist household is defined as a facility or group of facilities that provide accommodation, preparation and serving of food and beverages or only accommodation services, located in a rural (rural) environment with elements of local landmarks and heritage. (Hospitality Law, no. 17/2019, Serbia). Legal regulation of the status of RTHs as a type accommodation facilities and prescribing their categorization was an important step for improving the field of rural tourism in Serbia, especially from the aspect of service quality.

Minimum standards also need to be determined in rural accommodation development and in concordance with international minimum standards. Rural accommodation should in the future focus on authentic and genuine features. Branding of this accommodation type should be used as a means of future differentiation (Durman-Pušara, 2012). Accommodation strategy defines new types of accommodation that Serbia might offer: tree houses, grass igloos and ship houses. Tree houses are especially interesting for tourism development which is connected to the nature and could be implemented on Stara planina (mountain), primarily for children and young adults.

However, the percentage share of RTHs in the total accommodation capacities (in the total number of rooms and the total number of beds) is very low in the whole observed period (Table 3).

Table 3. Accommodation facilities - rural tourist households (rooms and beds) by type of tourist resorts, Republic of Serbia, 2014-2019.

Type of tourist place	Rooms						Beds					
	2014	2015	2016	2017	2018	2019	2014	2015	2016	2017	2018	2019
Spas	98	98	104	104	23	19	304	304	318	320	73	61
Mountain resorts	-	92	98	120	155	207	-	227	239	307	391	534
Other tourists' resort	5	141	331	390	391	362	-	319	842	941	1.093	994
Other resort	6	52	50	61	47	56	15	147	141	155	123	143
Total:	109	383	583	675	616	644	344	997	1.540	1.723	1.680	1.732
% participationin the total:	0.3	0.8	1.3	1.5	1.3	1.3	0.3	0.9	1.4	1.6	1.5	1.4

Source: Authors, based on Statistical Yearbook of the Republic of Serbia 2015, 2016, 2017, 2018, 2019, 2020

It can be noticed that *rural tourist households are mostly concentrated in "other tourist places"*. In 2019, about 56% of rooms, and about 57% of beds were located in these places.

Tourist turnover - In recent years, Serbia has registered an increasing number of tourist arrivals and overnight stays. Tourist arrivals in 2019 amount to 3.7 million, and about 10 million overnight stays were realized (Statistical Yearbook of the Republic of Serbia 2020). Overnight stays realized in the so-called "other tourist places" and "other places" can be considered overnight stays in rural tourism (Table 4).

Table 4. Overnight stays in rural areas in the period from 2014 to 2019, the Republic of Serbia

Year	Number of nights in all tourist places	Number of overnight stays in rural areas ("other tourist places" and "other places")	% share in total number of nights in all forms of tourism
2014	6.086.275	1.218.552	20.02
2015	6.651.852	1.352.199	20.33
2016	7.533.739	1.485.975	19.72
2017	8.325.144	1.681.237	20.19
2018	9.336.103	1.913.030	20.49
2019	10.073.299	2.108.365	20.93

Source: Authors, based on Statistical Yearbook of the Republic of Serbia 2015, 2016, 2017, 2018, 2019, 2020

Based on previous data, *the average percentage of registered overnight stays in rural tourism in Serbia, in the period from 2014 to 2019, is 20.28%.* Compared to a similar survey from 2015, which covered the period from 2005 to 2014, when the average percentage of registered overnight stays in rural tourism in Serbia was about 21.21%, it can be concluded that this share remained at approximately the same level. The following table (Table 5) shows the results of RTHs turnover and their participation in the total realized arrivals and overnight stays.

Table 5. Tourist arrivals and overnight stays, rural tourist households, Republic of Serbia, 2014-2019.

Years	Total Arrivals	Arrivals RTHs	% in total arrivals	Overnight Stays	Overnight stays RTHs	% in total overnight stays
2014	2.192.268	164	0.01	6.086.275	502	0.01
2015	2.437.165	1.523	0.06	6.651.852	4.910	0.07
2016	2.753.591	4.335	0.16	7.533.739	14.497	0.19
2017	3.085.866	5.061	0.16	8.325.144	16.040	0.19
2018	3.430.522	5.584	0.16	9.336.103	15.039	0.16
2019	3.689.983	8.529	0.23	10.073.299	24.677	0.24

Source: Authors, based on Statistical Yearbook of the Republic of Serbia, 2015, 2016, 2017, 2018, 2019, 2020

It can be noticed that in the entire observed period, RTHs record a very low share. Table 6. analyzes the data on the capacity utilization of rural tourist households. The data in the Table 6. indicate a very low level of RTHs capacity utilization on an annual basis. However, the maximum capacity, which is assumed here when calculating the number of possible overnight stays, is not possible in practice and it would be more realistic to start from the so-called working capacity.

Table 6. Number of overnight stays, number of beds, average number of overnight stays per bed, number of possible overnight stays and utilization of accommodation capacities RTHs, Serbia, 2014-2019.

Year	Number of overnight stays	Foreign	Number of beds	Average number of overnight stays per bed	Number of possible overnight stays	% in capacity utilization
1	**2**	**3**	**4**	**5** (2:4)	**6** (4 x 365)	**7** (2:6 x 100)
2014	502	43	344	1.5	125.560	0.4
2015	4.910	708	997	4.9	363.905	1.3
2016	14.497	804	1.540	9.4	562.100	2.6
2017	16.040	727	1.723	9.3	628.895	2.6
2018	15.039	994	1.680	9.0	613.200	2.5
2019	24.677	2.837	1.732	14.2	632.180	3.9

Source: Authors, based on Statistical Yearbook of the Republic of Serbia, 2015, 2016, 2017, 2018, 2019, 2020

If, due to the seasonal nature of the demand for rural tourism, it is assumed that the working capacity is 4 months or 120 days, then, for example, in 2018, the number of beds 1.680 would be multiplied by 120 days and 201.600 possible overnight stays would be obtained. In that case, the percentage of capacity utilization would be 7.5 (15.039: 201.600 x 100). Using the data from the table, it is possible to calculate *the days of full capacity utilization (% capacity utilization x 365: 100)*. Thus, this indicator in 2017, for example, is 9.5 days (2.6 x 365: 100) and means that during 2017, all accommodation capacities in the RTHs in Serbia were occupied for 9 days, and vacant for the remaining 356 days. In 2018, this indicator is 9.1 days, and 14.2 days in 2019. Although, the

analyzed indicators show a trend of growth, they are still at an unsatisfactory level. It can also be noted that the development of tourism in the RTHs relies primarily on domestic demand. The participation of foreign guests, although on the increase in the observed period, can be assessed as modest (for example, in 2018 it amounts to about 7% in the total number of nights in RTHs, and in 2019 about 12%). The following tables (Table 7. and Table 8.) discuss the arrivals and overnight stays of tourists by categories of accommodation.

Table 7. Tourist arrivals at rural tourist households, by household categories, Serbia, 2014-2019.

Year	4*		3*		2*		1*		Total
	Number	%	Number	%	Number	%	Number	%	
2014	5	3.05	94	57.32	6	3.66	59	35.98	164
2015	72	4.73	746	48.98	575	37.75	130	8.54	1.523
2016	351	8.10	3.492	80.55	492	11.35	-	-	4.335
2017	1.909	37.72	2.495	49.30	657	12.98	-	-	5.061
2018	1.231	22.05	3.718	66.58	519	9.29	116	2.08	5.584
2019	1.859	21.80	4.134	48.47	2.012	23.59	524	6.14	8.529
Total:	*5.427*	*21.54*	*14.679*	*58.26*	*4.261*	*16.91*	*829*	*3.29*	*25.196*

Source: Statistical Yearbook of the Republic of Serbia, 2015, 2016, 2017, 2018, 2019, 2020

The largest number of arrivals in the observed period was realized in RTHs middle category (three-star), followed by households with four stars. The lowest number of arrivals was recorded in the lowest category accommodation. In the last six years, a total of 25,196 arrivals were realized, in which three-star households participated with about 58%; four-star with about 21%; two-star with about 17% and one-star with about 3%. The average annual number of arrivals in the observed period is about 4,199 arrivals. Similar conclusions can be drawn when it comes to overnight stays (Table 10).

Table 8. Tourist overnight stays in rural tourist households, by household categories, Serbia, 2014-2019.

Year	4*		3*		2*		1*		Total
	Number	%	Number	%	Number	%	Number	%	
2014	20	3.98	350	69.72	6	1.20	126	25.10	502
2015	323	6.58	2.693	54.85	1.585	32.28	309	6.29	4.910
2016	1.161	8.01	11.610	80.09	1.726	11.91	-	-	14.497
2017	5.306	33.08	7.949	49.56	2.785	17.36	-	-	16.040
2018	3.472	23.09	9.064	60.27	2.239	14.89	264	1.76	15.039
2019	4.575	18.54	12.419	50.33	6.118	24.79	1.565	6.34	24.677
Total:	14.857	16.94	44.085	58.26	14.459	19.11	2.264	2.99	75.665

Source: Statistical Yearbook of the Republic of Serbia, 2015, 2016, 2017, 2018, 2019, 2020

Note: table created by the author

In the entire observed period, the largest number of overnight stays was realized in three-star households (about 58%), followed by four-star households (about 17%). The

lowest number of overnight stays was realized in one-star facilities (about 3%). The average number of nights per year is about 12,611 nights.

Conclusions

The development of tourism in rural households and farms has multiple significance, not only for tourism, but for the entire rural population and the economic development of rural areas.

The monitoring of the trends of selected indicators of rural development of Serbia (tourists' arrivals, tourists' arrivals by household categories, household categories and accommodation facilities) indicates generally the positive tendencies recorded in the period of six years (2014-2019). In the development of rural tourism in Serbia, rural tourist households have a unique character and significance that distinguishes them from other facilities that also participate in meeting the tourist needs in rural areas. However, their share in the total accommodation offer, as well as the results of the realized turnover can be assessed as modest. The results of the research in the paper indicate low tourist turnover and low capacity utilization rate of rural tourist households on an annual basis. The analysis conducted in this paper is based mostly on quantitative indicators of rural development, which can be singled out as a key limitation of the research.

However, according to the research, a large number of resources in rural areas are not developed and do not contribute to the development of tourism. In the area of accommodation capacities, a lack of constructed facilities was noticed, as well as international standards and quality guarantees. This research also indicates that categorization is inadequate and it is necessary to estimate the point to which legal and administrative procedures reached in recognizing new forms of accommodation in rural tourism in Serbia. From the above, it can be concluded that the basic hypothesis of the research H1 has been confirmed.

Seasonality plays an important role in tourist business survivability and sustainability and it is also a significant factor for rural households involved in tourism. The problems related to the pronounced seasonality which reflects unfavorably on the occupancy of accommodation capacities in rural areas were also pointed out. The average occupancy of rural units per year is only 4%, which is very low compared to 21% in other accommodation units.

The need for improvement, standardization and diversification of rural accommodation, food and beverage supply and other services, but also for the so-called structured experiences of rural tourism based on activities, accommodation and built facilities was emphasized. Minimum standards also need to be determined in rural accommodation development and in concordance with international minimum standards.

For any further development of Serbian rural tourism it is necessary to support for start-up and investment in non-agricultural activities in rural areas especially in rural

accommodation, shops, restaurants, tours. It is necessary to solve the problem of seasonality in and ensure capacity utilization even out of season. Minimum standards also need to be determined in rural accommodation development and in concordance with international minimum standards.

The current global health crisis (Covid-19), has further strengthened the need for people to stay away from crowds and big cities. In the last two years rural tourism is going through changes due to the Covid-19 pandemic and as a result there have been sudden changes in the demand for accommodation and stays in rural destinations in Serbia. Restrictions increased domestic tourism, especially in rural areas due to the fact that these areas have cleaner air, a small population density and risk of infection is minimal. It is assumed that the Covid-19 pandemic will continue to support the cultural, environmental, ecologic and socio-demographic, as well as economic sustainability of rural areas in Serbia.

When it comes to the development of rural tourism in the future, efforts should be focused on further improving the quality of supply, in line with the observed increased demand for middle and higher category accommodation and marketing instruments to attract certain target groups of tourists to make better use of existing facilities. The mainstay of development should continue to be domestic demand from urban areas. Having in mind the international trends and Covid-19 crisis appropriate measures should be taken aimed at increasing the quality, authentic accommodation capacities that present the local cultural identity of rural areas, the preservation of which is the guarantor of the development of this type of tourism.

Conflict of interests

The authors declare no conflict of interest.

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CROP RECEIPTS AS ALTERNATIVE FINANCIAL INSTRUMENTS

Vlado Kovačević[1], Irena Janković[2], Jelena Minović[3]

**Corresponding author E-mail: vlado_k@iep.bg.ac.rs*

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ABSTRACT

The aim of the paper is to provide insights into the lending against crop receipts mechanism. Crop receipts emerged as promising financial instruments creating an additional type of collateral for agricultural producers that pledge their future agricultural production in order to finance ongoing production activities. At the same time, they offer an alternative investment opportunity to banks through the creation of a new asset class. European Bank for Reconstruction and Development supported Serbia in establishing a crop receipt system with the aim to serve as a pilot project for Europe. This is the first analysis of the crop receipts system in Serbia. The methodology applied consists of interviews with bank representatives, extensive literature research, descriptive statistics and comparative analyses. Results are indicating that the main shortcomings in the crop receipts system include the lack of specialised shareholders' knowledge, the absence of subsidization of interest rates on loans against crop receipts followed by the lack of appropriate Central bank policy, standardization and securitization

Introduction

The major obstacle for agricultural producers may be found in capital constraints caused by limited credit access which hinder investments in production, implementation of modern technologies, farmers' literacy, etc. (Trzeciak-Duval, 2003; Popović et al., 2018). The main characteristic of agricultural financing is the time discrepancy between investments and expected revenue due to the long production period. Producers need

1 Vlado Kovačević PhD, Senior Research Associate, Institute of Agricultural Economics, Volgina 15 Street, 11000 Belgrade, Serbia, Phone: + 381 63 55 44 14, e-mail: vlado_k@iep.bg.ac.rs, ORCID ID (https://orcid.org/0000-0002-2902-6496)

2 Irena Janković PhD, Associate Professor, University of Belgrade – Faculty of Economics, Kamenička 6 Street, 11000 Belgrade, Serbia, Phone: +381 69 8066 336, e-mail: irena.jankovic@ekof.bg.ac.rs, ORCID ID (https://orcid.org/0000-0003-1115-4702)

3 Jelena Minović PhD, Senior Research Associate, Institute of Economic Sciences, Zmaj Jovina 12 Street, Belgrade, Serbia, Phone: +381 69 88 93 301, e-mail: jelena.minovic@ien.bg.ac.rs, ORCID ID (https://orcid.org/0000-0001-6254-4888)

funds for the next growing season and loans can be repaid at the harvest time. The timely access to credit enables them to start adequate investments resulting in improvement in production and profitability (Asante-Addo et al., 2017; Iftikhar & Mahmood, 2017; Pantić et al., 2021; Owusu, 2017; Saqib et al., 2018; Kong et al., 2020).

Crop receipts emerged as alternative instruments in agricultural financing. There are other terms used for crops receipts, such as future crop receipts, pre-harvest financing instruments and agrarian receipts. Crop contracts are often named pre-harvest financing instruments because future crops during the production process are pledged, whereas warehouse receipts are named post-harvest financial instruments where stored commodities are serving as loan collateral (Kovačević et al., 2016; Miranda et al., 2019).

A crop receipt is a document issued by an agricultural producer or cooperative to deliver a certain quantity of an agricultural commodity or to repay a certain amount of money at a future date. Crop receipts exist in two forms – crop receipts with physical or cash settlement. Based on this instrument, the lender provides a certain amount of money or inputs that are to be settled upon crop receipt maturity. The lenders for delivery-based crop receipts may be processors or input suppliers, while for financial settlement-based crop receipts the lenders are banks (Gonçalves et al., 2005).

In the situation of physical settlement, the producer is obliged to deliver certain products at the arranged place of delivery on the maturity date. Financial crop receipts result in financial settlements upon maturity (agricultural product is only the collateral).

Having out-of-court dispute resolution, crop receipts guarantee rapid execution in case of non-performance or breach of contract on the part of the crop receipt issuer, providing low-risk environment for lenders (Hollinger et al., 2019).

The most important attribute of crop receipts is the reduction of risks for the buyers. In general terms, the main objectives of the pre-harvest financing are to:

1) finance production with future crops as collateral;
2) guarantee the supply of agricultural products;
3) provide alternative investments for lenders.

Scientific research in the field of pre-harvest financing is limited. The analysis of the crop receipts is constrained by the lack of data. This lack of data is the result of the co-existence of many crop receipts registers for different assets. As a result, a small percentage of crop receipts are centrally registered - the ones to be traded on secondary markets.

This article fills the gap in scientific research of crop receipts' fundamentals. The analysis is based on the analysis of the only three, up to the present moment, established pre-harvest financing systems in the world. In addition, this is the first comprehensive analysis of the Serbian pre-harvest system as the sole pilot project for the European area.

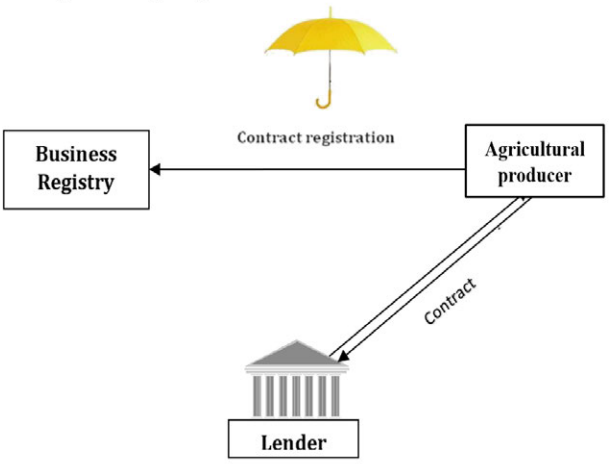
Overview of the existing pre-harvest financing systems

This part of the paper provides an overview of the only three pre-harvest systems in the world established up to the present moment – Brazilian, Serbian and Ukrainian.

The annual investments requirements of agriculture in Brazil in financial terms reach about USD 149 billion, 40 percent of which is provided by the crop receipts (FAO, 2011). Physical delivery-based crop receipts are introduced in Brazil by the Law on 'Note of Agricultural Product' in 1994, which established the Certificate (or Note) of Agricultural Product (Cédula de Produto Rural). The financial crop receipts are introduced in 2001. Initially were introduced crop receipts were with the physical settlement, while years later financial settlement crop receipts emerged. Based on the crop receipts secondary financial instruments have been created as pre-harvest instruments through the securitization process (Leão de Sousa & Pimentel, 2005; Ministry of Agriculture, Livestock and Food Supply Brazil, 2010; Hollinger et al., 2019; Vujović & Vujović, 2021).

The crop receipts in Serbia are introduced in 2014, by the Law on financing and Securing Financing of Agricultural Production. The Serbian crop receipt system was aimed to be a pilot project for Europe supported by the European Bank for Reconstruction and Development (EBRD) and the FAO providing technical support in drafting and implementation. Figure 1 presents the crop receipt system in Serbia.

Figure 1. Crop receipt system in Serbia



Source: Authors' presentation

The crop receipts in Serbia are based on the continental legal system as a contractual obligation. The crop receipts are registered in the Business Registers Agency (BRA), which serves as the central record of crop receipts preventing to use the future crops from the same plot as collateral more than once. With the support of the EBRD, the electronic record of pre-harvest financing agreements was introduced in 2015 and it is publicly

available. The Law defines, as in the other two systems, the mandatory information that each contract must contain. Legislatively facilitated out-of-court enforcement in the event of non-performance of contracts by farmers has also been established.

The crop receipt system was introduced in Ukraine by a pilot project in 2011 and in 2013 a Law on agrarian receipts was enacted (Andriievskyi et al., 2012; Starodubtsev & Bakai, 2020). Despite high expectations, that in the medium run crop receipts will be able to provide at least USD 1.5 billion in additional loans, the crop receipt system in Ukraine significantly underperformed (Polyarush, 2018). As in Serbia, the continental legislative framework has been applied resulting in the pre-harvest instrument in the form of a contract. Ukraine crop receipts are secured by the pledge of future crops from a particular land plot and creditors receive a priority for enforcement (Sokolska et al., 2020). Crop receipts are registered by notaries, making them publicly visible (Radchenko, 2013). Creditors have the right to monitor the processes of future crops production and interrupt possible breaches of agreed procedures by the debtors (Stender, 2017).

Materials and methods

The analysis is based on the survey of the accomplished results of the establishment of the pre-harvest system in Serbia and a comparative analysis of the Brazilian, Ukrainian and Serbian systems.

Based on the comparative analysis of the existing pre-harvest systems core milestones are identified and compared.

To provide objective results, the following methods were used in the paper:

- Questionnaire to commercial bank representatives;
- Descriptive statistics;
- Comparative analyses.

The questionnaire for licensed commercial banks' representatives in Serbia was aimed to provide insights into their attitudes related to lending against crop receipts. All licensed commercial banks were interviewed – a total of 33 banks (National Bank of Serbia, 2021), while 21 banks responded to the questionnaire. The survey was conducted between January15th and January 28th 2021.

Besides the questionnaire, the data sources for the analysis included the Business Registers Agency of the Republic of Serbia (BRA), the Statistical Office of the Republic of Serbia (SORS) and the Ministry of the Agriculture, Forestry and Water Management of the Republic of Serbia (MAFWM).

Results

Serbian crop receipt system underperformed expectations. Hereunder are analysed numbers of contracts and loan values.

Table 1 presents the results of crop receipts financing in Serbia.

Table 1. Total value and number of crop receipts on annual basis in the period 2015-2020

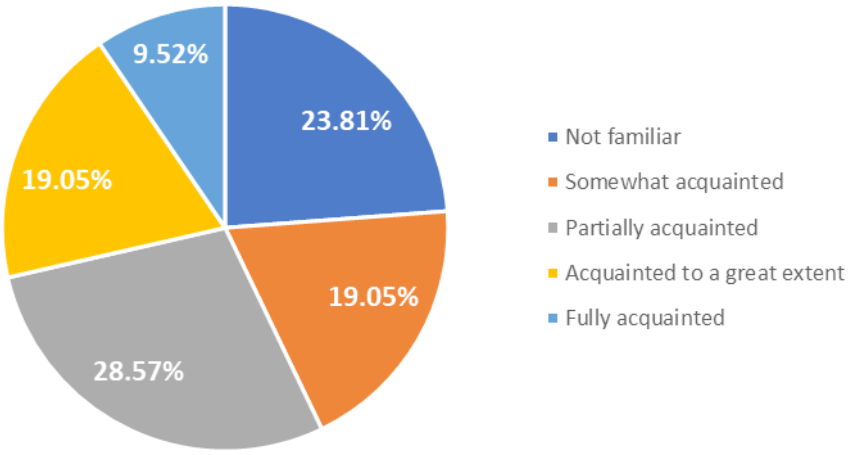
Year	Total value (EUR)	Total number of contracts
2015	2 001 742	50
2016	39 860	2
2017	316 902	3
2018	186 001	4
2019	128 343	4
2020	776 436	30
Average	574 881	13.28
St.dev.	745 651.41	20.02

Source: Authors' calculation based on BRA (2021)

What can be noticed is significant variation in total value and number of contracts over years. In the initial year value was EUR 2 001 742 and the number of contracts was 50, the highest compared to other years due to the decision to use crop receipts of the one large processor, the sugar refinery, which significantly affected crop receipts results. Significant volatility and small volume of crop receipts characterized crop receipts results in the whole period.

In continuation are presented results of the interviews with relevant bank representatives related to the lending against crop receipts. Figure 2 presents respondents' attitudes toward the level of literacy related to the pre-harvest system.

Figure 2. Answers to the question: Are you familiar with additional loan security through the pre-harvest financing system?



Source: Authors' presentation of survey results

According to the results of the analysis, around 28% of respondents have significant or full knowledge on lending against warehouse receipts.

The importance of public policies for the development of pre-harvest financing was further analysed (Table 2). The respondents could rank the stated policy tool by using a scale from 1-5 where 1 stands for Not significant, while 5 stands for Very significant.

Table 2. Assessment of the public policies' effect on the pre-harvest financing

Rating*	A number of answers to the statement: Standardization of the pre-harvest financing agreements, securitization and secondary trading would affect the development of the pre-harvest system financing.	A number of answers to the statement: The decision of the National Bank of Serbia on adequate rating for the pre-harvest financing would affect the development of the pre-harvest financing.	A number of answers to the statement: Subsidizing the interest rate for loans based on the agreement on pre-harvest financing would affect the development of the pre-harvest financing.
5	11	15	17
4	4	2	2
3	2	2	1
2	3	2	0
1	1	0	1
Average	4.1652	4.2228	4.4296
St.dev.	1.3038	1.0282	1.1650

Source: Authors' presentation of survey results

Bank representatives assessed that interest rate subsidies for loans based on the agreement on pre-harvest financing represent the most important tool for the development of the pre-harvest financing in Serbia. The second important tool is the rating system of the Central bank which is seen as useful for scaling up lending against crop receipts. As third, but still significant, is seen the standardization of the pre-harvest financing agreements, securitization and secondary trading that would be of high importance for the development of the pre-harvest financing system.

Discussions

After six years of functioning of the crop receipts system in Serbia, the analysis of the results was conducted. Based on the results, measures have been proposed to improve the crop receipts system for the farmers, agricultural policymakers, financial institutions and the National Bank of Serbia. A comparative analysis of the Brazilian and Ukrainian crop receipt systems was conducted in order to draw conclusions and recommendations.

Sixteen core elements for the crop receipt system are recognized and analysed.

1) Legal status of the pre-harvest financing instruments differs so that, based on the Anglo-Saxon legal system in Brazil it is security - Promissory note, while in Ukraine and Serbia, based on the continental legal system it is a bilateral contractual agreement. Starodubtsev & Bakai (2020) recognized the need for Ukrainian crop receipts to be

converted into financial instruments in order to facilitate loan provision and secondary trading. Analysis in this paper is aligned with previous ones, stressing the need for the legal framework for the crop receipts as standardized debt instruments rather than individual contracts.

2) Agricultural holding size, given that lenders are not interested in small size of crop receipts. Compared to the Brazilian and Ukrainian systems where large holdings are dominating, with an average size of just 5.4 ha (SORS, 2012) Serbia has unfavourable agricultural holding structure for crop receipts' growth. As small crop receipts are not attractive for financiers, aggregation of crop receipts throughout cooperatives is essential. For the development of the crop receipt system in Serbia and most developing countries, a different approach is needed – to build scale through cooperatives aggregation.

3) Crop receipt elements represent the minimum elements that each pre-harvest financing certificate must have and are defined in all three systems.

4) Crop receipt form is defined as a standardized document only in Brazil, while in Serbia and Ukraine it is a contractual obligation and there is no standardization. Brazilian crop receipt form is an important step toward standardization and crop receipts secondary trading. A good example of commodity receipts can be found in Serbia where the warehouse receipt form is printed by the National Bank of Serbia (The Law on Public Warehouses "Official Gazette of RS", No. 46/2006). As a consequence, warehouse receipts in Serbia are easy to pledge, transfer pledge and trade. Based on the conducted research, the introduction of a standardized form of these financial instruments can be recommended for the development of an efficient crop receipt financing system.

5) Eligible agricultural products, in the case of Brazilian and Ukrainian pre-harvest financing instruments all agricultural products are eligible. In Serbia, pre-harvest financing agreements are limited to plant-based agricultural products. Since plant production takes place on a certain plot, pre-harvest financing is less risky in relation to the financing of livestock production, so the Serbian model can be recommended as a first step in crop receipt system development.

6) Crop receipts record is established in all three systems. The Register of Contracts on Financing Agricultural Production in Serbia started operating within the Business Registers Agency on June 1, 2015, and represents a unique, central, public and electronic database on concluded financing agreements, as well as the documents on the basis of which the registration was performed (BRA, 2021). The Serbian software necessary for the operation of the Register was developed within the technical assistance project of the Food and Agriculture Organization of the United Nations (FAO) and the EBRD. The central record of pre-harvest financial instruments is of great importance since it provides additional security for the contract execution, i.e., a potential financier of agricultural production can inspect the central database and see if the product from that plot has already been pledged, which prevents the possibility that the future product from the same plot will be pledged several times. It can be concluded that for the efficient pre-harvest financing it is important to establish: (1) reliable electronic central

record of all crop receipts (2) enrolment and data change need to be easy with low costs (3) transparency and visibility of data to all stakeholders in real-time and (4) connectivity to OTC market, commodity exchanges, etc. The central register of crop receipts in Serbia can be a positive example since Brazil has no central registry for all pre-harvest instruments resulting in lower transparency. The Register of crop receipts is a unified information system in Ukraine but according to Starodubtsev and Bakai (2020) there is a need for its transformation into electronic form.

7) Enforcement procedure in the case of default. None of the conditions above would suffice in case the instrument does not work in a default context. In all three pre-harvest systems there is an efficient out-of-court enforcement procedure in place. Starodubtsev and Bakai (2020) are stressing out the need for improving enforcement procedure for crop receipts where the transfer of pledged assets to the domestic lender is in place while the legislation needs to allow transfer to non-residents by customs clearance of goods for movement across the state border.

8) Additional mechanisms to increase the security of contract execution in the form of additional sanctions for non-performance of contracts are found in all three systems. In the Ukrainian system, that is the possibility of criminal liability for an unscrupulous debtor. A very interesting model that works successfully and that could be recommended to all other pre-harvest systems is in Serbia where in case of non-performance of the contract the producer is excluded from the system of government subsidies during a certain period.

9) Force majeure events, in the Serbian system producers are protected in the case of adverse events (adverse weather conditions, fire, floods, etc.) with the possibility to transfer the obligation to the next production period. Although this is important for producers, it could not be recommended because it raises the question of who and how will determine the occurrence of adverse conditions and also limits the possibility of standardization and secondary trade of pre-harvest instruments.

10) Agricultural insurance of products under crop receipt is mandatory in the Brazilian system while optional in the Ukrainian and Serbian. The Brazilian system can be an example as the insurance obligation leads to standardization and the possibility of securitization and secondary trading of crop receipts.

11) Future crop valuation is an important issue for the functioning of pre-harvest financing. It is the valuation of the products under crop receipts as the maturity date is in the future. Brazil is the only country with an established liquid commodity derivatives market, which allows valuation of the crop receipts at the time of issuance. Also, the derivative market is allowing hedging as the crop receipts can be used to meet the initial margin on a futures position.

12) Commodity exchange crop receipts primary issuance and secondary trade. Brazil is the sole country with developed primary issuance of the crop receipts at the commodity exchange and deep crop receipts secondary market. It can be assessed that secondary

trading of crop receipts is of great importance for attracting investors. On the other hand, trading enables producers to take their crop receipts to the commodity exchange auction and get the most favourable financing conditions. Based on the Brazilian experience it can be recommended that standardization of crop receipts is a necessary precondition for secondary trade. Similar results are derived from the Starodubtsev and Bakai (2020) research highlighting the importance of amending Ukraine legislation to recognize crop receipts as a security in order to establish an exchange and over-the-counter trading.

13) Crop receipts securitization. Among the surveyed countries Brazil is the only country with a significant level of crop receipts uniformity. Securitization and the possibility for trade with this financial instrument is an important part of the Brazilian pre-harvest system's success.

14) Tax incentives are very important, making the investment in pre-harvest instruments more attractive to creditors. Only Brazilian crop receipts investors are granted income tax reliefs. No tax reliefs were introduced in the Ukrainian and Serbian systems. The tax relief in the Brazilian experience has proven to be very important in facilitating the secondary trade of crop receipts and can be recommended.

15) Central bank role. Each central bank determines the rating of loans based on the level of risk they carry. Central bank favourable rating results have several effects. The first is "cheaper" credit because the commercial bank, in the case of a better rating, has the obligation to make a smaller deposit with the central bank. Another effect is the increase of the overall trust in these instruments since a better rating sends a positive signal that pre-harvest financing instruments are secure collateral. In Brazil, a favourable rating has been established for pre-harvest financing instruments. A positive example can be found in Serbia where the National Bank of Serbia in 2011 determined a favourable rating for loans against warehouse receipts, positively affecting the volume of lending and lending conditions (Kovačević et al., 2021).

16) Other supports were found in the Brazilian system where the interest rate for loans against crop receipts is subsidized, while in Serbia and Ukraine such support measures have not been implemented. The practice has shown that the introduction of an interest rate subsidy is of great importance. The importance of introducing this measure was also shown in Serbian practice where EBRD in 2011 through a risk share program via three commercial banks invested EUR 50 million to support loans against warehouse receipts (Zakić et al., 2014)

Conclusions

Chronic lack of funds in financing agricultural production is one of the most important limiting factors for the development of the agribusiness sector. In order to solve this problem Brazil, Ukraine and Serbia have introduced pre-harvest financing systems as a vehicle for more efficient agricultural financing.

It can be concluded that the Serbian crop receipt system fell short of the expectations. A small number and value of the crop receipts were issued. The findings are suggesting the milestones that need to be reached for development of the pre-harvest financing among which the most important are: promotion and education, crop receipt standardization, scaling of the volume and the size of the crop receipts, central banks' favourable rating for loans against crop receipts, subsidizing the interest rates, tax incentives for investors in crop receipts, etc.

It can be concluded that crop receipts are promising financial instruments, in particular for developing countries, where producers have difficulties accessing the credit market. Lessons learned during the first six years of the European pilot project of the EBRD in developing crop receipt system in Serbia are valuable for improving the Serbian system as well as for the countries aiming to establish alternative pre-harvest financing in agriculture.

The most significant limitation of the analysis of pre-harvest financing lies in the lack of systematized data and scientific research in this area. Systemized and publicly available data on pre-harvest agricultural financing would create a solid ground for future research in this area.

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Conflict of interests

The authors declare no conflict of interest.

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THE ROLE OF AGRICULTURE IN THE ECONOMIC STRUCTURE OF SERBIA AND BUDGET SUPPORT FOR RURAL DEVELOPMENT OF KLADOVO MUNICIPALITY

Biljana Grujić Vučkovski[1], Zoran Simonović[2], Nikola Ćurčić[3], Vuk Miletić [4],

**Corresponding author E-mail: biljana_g@iep.bg.ac.rs*

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ABSTRACT

The purpose of writing the paper is the situation in agriculture in Serbia and the municipality of Kladovo, as well as the importance it achieves in the economic structure. At the level of Serbia, the importance of agriculture, forestry and fisheries (AFF) is analyzed through their contribution to gross domestic product (GDP) creation from 2016 to 2020, while for the municipality level the importance is determined by the amount of funds allocated in the local self-government unit (LSU) for the needs of agriculture from 2018 to 2020. The obtained results indicate a high share of AFF in GDP creation (6.3% during 2020) and a low share of budget funds in the total budget of the municipality for support of rural development (2.34% in 2020). The aim of this paper is to analyze the possibilities for further development of agriculture in the Republic and the Municipality. The paper uses methods of critical analysis of relevant literature, as well as descriptions for interpreting the results obtained by empirical research.

Introduction

Agriculture is one of the branches of the economy that is of exceptional importance for the country itself as well as for the rest of the world, and the sustainable development

1 Biljana Grujić Vučkovski, PhD, Scientific Associate, Institute of Agricultural Economics, Volgina 15, 11060 Belgrade, Serbia, Phone: +381116972858, E-mail: biljana_g@iep.bg.ac.rs, ORCID ID (https://orcid.org/0000-0003-2588-4888)

2 Zoran Simonović, PhD, Senior Scientific Associate, Institute of Agricultural Economics, Volgina 15, 11060 Belgrade, Serbia, Phone: +381116972858, E-mail: zoki@medianis.net, ORCID ID (https://orcid.org/0000-0002-2769-6867)

3 Nikola Ćurčić, PhD, Senior Scientific Associate, Institute Tamiš, Novoseljanski put 33, 26000 Pančevo, Serbia, Phone: +38113313092, E-mail: curcic@institut-tamis.rs, ORCID ID (https://orcid.org/0000-0003-3375-2690)

4 Vuk Miletić, PhD, Associate Professor, The College of Academic Studies "Dositej", Blvd. Vojvode Putnika 7, 11000 Belgrade, Serbia, Phone: +381600520154, E-mail: vuk.miletic88@gmail.com, ORCID ID (https://orcid.org/0000-0002-6250-6803)

of agriculture is a priority for both the nation and the world. However, the sustainable development of agriculture primarily implies the preservation of the environment and natural resources for future generations, and Wrzaszcz & Zielinski (2022) point out that this future state of resources should not be worse than the current one.

It is well known that the agricultural sector highly impacts the macroeconomic indicators of each country, and further, according to the authors (Nowak & Rozanska-Boczula, 2022; Arisoy, 2020), many environmental, economic and social functions are found in agriculture. This opinion is explained by the authors in a way that agriculture contributes to the creation of GDP, employs labour force, participates in shaping the foreign trade balance, provides food to the population, and provides raw materials to industry.

The authors of Mishra & Satapathy (2022) also expressed their views on the functions that agriculture performs in each country who believe that solving economic, social and environmental issues can contribute to the sustainable development of agriculture, and together form a whole that they have identified as the *"agricultural system"*. The mentioned authors explain *economic sustainability* as the capacity of an agricultural producer to produce enough food for his family, community and to contribute to the economic sustainability of agriculture. They define *social sustainability* as a set of measures that contribute to the quality of life of an agricultural producer, consumer and all members of a society. In *environmental sustainability* they have included environmental quality and natural resources. Therefore, the *"agricultural system"* designed in this way can contribute to the sustainable development of agriculture in a country, while it is necessary to constantly maintain strong links between these functions.

The author Arisoy (2020) especially emphasizes the importance of the social and economic function of agriculture from the aspect of creating the national income of the country and providing food for the population. Therefore, agriculture has been supported in every society since ancient times with the application of all precautionary measures for agricultural activities.

We can conclude that agriculture is significantly important also from the aspect of competitiveness, which affects other sectors and other countries, while the globalization of agriculture further strengthens the sense of competition within the agricultural sector (Nowak & Rozanska-Boczula, 2022).

If the region's agriculture is observed, e.g. European Union (EU), we can notice that it is very diverse and differentiated. One of the reasons for the differentiation of agriculture is the Common Agrarian Policy (CAP) in some countries within the EU, which is used by some countries in aim to be more competitive compared to other EU member states (Nowak & Rozanska-Boczula, 2022).

The need for a sustainable agricultural sector is increasing rapidly, but it also requires that it be implemented in a way that does not endanger food security (Wieliczko & Florianczyk, 2022). In 2001, at the third conference of the FAO, it was pointed out that agriculture: significantly affects the economic development of the least developed

countries, is important for the development of other economic areas and, therefore, has a high share in GDP. The results of their research (FAO, 2001) show that in two thirds of the least developed countries, the share of agriculture in the creation of GDP is 30-60% and they employ 40-90% of the population. Due to the strong ties of agriculture within the sector itself, as well as with other activities, a strong incentive is created for income generation and economic development of the least developed countries.

Frequently asked question is how agriculture can contribute to economic development, especially the reduction of the poor, who are more represented in rural than in urban areas. In some regions of the world, urban areas are becoming more and more populated, and the number of poor people who settle in cities is growing in proportion to the increase in urbanization. However, more and more poor people remain in rural areas than in urban areas, according to the authors Meijerink & Roza (2007), who estimates 60-75% of them are poor. South Asia and sub-Saharan Africa can be used as examples, where the share of the rural population in total is above 50%. We can say that in Serbia, too, the rural population is more exposed to poverty, primarily those who live in mountainous areas and earn income only from agriculture (Veličković & Jovanović, 2021). Authors Dimitrijević et. al. (2021) believe that they need to strengthen rural-urban ties in order to reduce rural poverty in developing countries.

Therefore, the participation of the poor remained the same, but they emigrated from rural to urban areas, so the predominantly poor population remained in rural areas.

One of the possible solutions for reducing poverty in rural areas, especially those engaged in agricultural production, is to promote investment in agricultural infrastructure and increase the representation of the advisory system (Pawlak & Kolodziejczak, 2020). These activities are of highly importance to developing countries because mentioned activities increase the productivity of agricultural production.

Also, state support in the form of non-refundable financial resources can contribute to reducing the price of used capital, increasing financial stability and greater competitiveness of agricultural producers (Alekseeva et. Al., 2022).

The author Kushter (2021) believes in socio-economic and political significance of agriculture in Serbia primarily due to its favorable geographical position. After 2010, there were significant changes in Serbia that affected the review of macroeconomic indicators. In order to achieve more efficient use of natural resources and maintain economic increase, fiscal and monetary reforms have been implemented in Serbia, the state administration has been restructured, which has influenced the liberalization of foreign trade (Ćurčić et al., 2021).

In the countries of region, the share of agriculture in GDP is higher than in the EU (1.5%): in Croatia 2.9%, Bosnia and Herzegovina 5.6%, Slovenia 2%, Hungary 3.3%, Romania 4% and 3.2% in Bulgaria (Ćurčić et. al., 2021). In the five-year period (2016-2020), the highest GDP growth rate was achieved in 2018, with an increase of 4.5% compared to 2017. After the negative rate of real growth of agriculture, forestry and

fisheries in the creation of total GDP of -11.4% in 2017, there was an increase of 15.1% in 2018, which is the share of this activity in the creation of GDP increased from 6% to 6.3%. During 2020, the share of AFF in the creation of GDP was 6.3% and 2.2% higher than in 2019.

In the structure of the economy of the municipality of Kladovo, agriculture has the most significant position. However, the budget of the municipality is insufficient for further development of agriculture and retention of the population in rural areas. More precisely, during 2020. to support rural development, the municipality planned only 2.34% of funds (EUR 17,010) of the total budget. Since the municipality of Kladovo does not plan funds in its budget to subsidize the interest rate on agricultural loans approved by commercial banks, the recovery of agriculture will be difficult and gradual.

Materials and methods

The paper predominantly presents data from the Statistical Office of the Republic of Serbia, which are available in electronic form within the *Farm Structure Survey (FSS)*. Analyzed indicators by whom are shown the importance of AFF activities for the degree of Serbia are changes in GDP and gross value added (GVA), as well as participation of AFF in GDP creation. For the degree of the municipality of Kladovo, the importance of AFF in the economic structure is shown by the amount of funds allocated in the budget of the LSU for the agriculture requirements.

The paper is presented by three basic units - graphics, statistical reviews and comments. The paper uses a critical analysis of the relevant literature from plentiful authors aligned with the research topic. Also, the method of description is used in the part of the paper that describes the results of empirical research. In accordance with the obtained results, adequate comments and conclusions were given.

Results and Discussion

We know that the country's economic growth is best measured by GDP. The basic indicators of economic growth are employment, foreign trade balance, level of capital and the like. (Cvetković et al., 2021). We also know that there is no certain generally accepted theory that would contribute to structural changes in the country's economy (Ćorović et al., 2021). Accordingly, we believe that there is no generally accepted activity that could contribute to the economic growth of the country, but that every economic branch and their interconnectedness is important.

Industry is important for the economic development of every country. When it comes to Serbia, apart from industry, agriculture also has an important place, but additional reforms and changes are needed in order to remain competitive with other activities. However, these changes are not only necessary for the agricultural sector, but also for the entire economic system in order to increase Serbia's development opportunity.

Observing the contribution of agriculture to the creation of GDP, the authors Popović & Grujić (2014) assess agriculture as an activity which could be used for establishing further development of the economic system. Table 1 shows the development of GDP and GVA[5] in Serbia from 2016 to 2020.

Table 1. Changes of GDP and GVA in Serbia from 2016 to 2020 (in %)

Indicators	Year	GVA	GDP
Share of GDP	2016	82.9	100
	2017	83	100
	2018	82.9	100
	2019	82.7	100
	2020	83.1	100
Real growth rates, previous year = 100	2016	2.9	3.3
	2017	2.1	2.1
	2018	4.3	4.5
	2019	4.4	4.3
	2020	-0.8	-0.9

Source: SORS, eletronic database, National accounts, GDP by production approach, GDP

The data presented in the table show that in the five-year period, a positive growth of both GDP and GVA was recorded. The share of GVA in total GDP was around 83%, while the highest real growth of GVA was achieved during 2019 and amounted to 4.4% compared to 2018. However, GDP achieved the highest growth rate in 2018 with a value of 4.5% compared to 2017. We can also see that 2020 ended with a decrease in GDP of -1%, which is a good result compared to the surrounding countries (Albania -3.5%, Bulgaria -3.8% and Romania -3.9%). The Annual Financial Stability Report 2020 points out that the significant drop in GDP was due to reduced economic activity caused by the virus pandemic, and the service sector - transport, tourism, catering trade - was most affected.

The following table (Table 2) shows the share of total GVA and AFF activity in total GDP from 2016 to 2020. In this analysis, agriculture means agricultural production, hunting and related catering trade.

5 Gross value added is a measure of the participation of individual producers, activities or institutional sectors in the GDP. It can also be explained as the value of output reduced by the value of intermediate consumption (SORS, Dictionary of National Accounts).

Table 2. Share of total GVA and AFF activity in total GDP from 2016 to 2020 (in %)

Indicators	2016		2017		2018		2019		2020	
	Share of GDP	Real growth rates, previous year = 100	Share of GDP	Real growth rates, previous year = 100	Share of GDP	Real growth rates, previous year = 100	Share of GDP	Real growth rates, previous year = 100	Share of GDP	Real growth rates, previous year = 100
Total GVA	82.9	2.9	83	2.1	82.9	4.3	82.7	4.4	83.1	-0.8
Agriculture, forestry and fishing	*6.8*	*7.5*	*6*	*-11.4*	*6.3*	*15.1*	*6*	*-1.7*	*6.3*	*2.2*

Source: SORS, eletronic database, National accounts, GDP by production approach, GVA by activities

The table shows that in the observed five-year period, the largest contribution of AFF activity in the creation of GDP was recorded in 2016 with a share of 6.8%, which is 0.8 pp. more than in 2017. The contribution of AFF activity in creating GDP in 2020 is less by 0.5 pp. compared to 2016. However, if we look at the last twenty years, we notice that in 2000 this share was as high as 17.1%, and in 2001 it was 14.7%. After 2001, the share of agriculture in the creation of total GDP has never returned to this level and is around 6.5% (SORS, database, national accounts).

If we take a look at the indicators for the analysis of the real economic growth rate in the current compared to the previous year, we notice that the highest real growth in the contribution of AFF to GDP was recorded in 2018 and it was 15.1% higher than in 2017, while it was 11.4% lower in 2017 compared to 2016. This negative rate of real growth can be explained as a consequence of adverse climate impacts. Also, we notice that in 2020, the AFF sector made a 2.2% higher contribution to GDP creation than in 2019.

When we analyze the total annual decrease or increase in GVA, we notice that in the five-year period, a growth of 12.9% was achieved. If we place this value over the five observed years, we get that the change in total GVA was on average 2.6% per year. If we repeat the same procedure with the indicator of the share of AFF activity in the increase / decrease of GDP, we come to the result that this activity in the three-year period contributed to the growth of 11.2%, and an average of 2.4% per year.

Therefore, in the observed period, agriculture had a significant share in the creation of Serbia's GDP and ranged from 6-7%. However, the rate of real economic growth has shown there are certain oscillations in their interannual flow (increase and decrease), but it is concluded that it still has a high share in the structure of the country's GDP.

***Administrative and geographical position of the municipality of Kladovo*.** According to its administrative affiliation, Kladovo has the status of a municipality, it is located in the Bor district, the region of Southern and Eastern Serbia. The district of the municipality is divided into Gornji (50.3% of the territory of the municipality) and Donji Ključ (49.7% of the territory of the municipality). The district of Donji Ključ

consists of and includes the alluvial plain of the Danube and the Danube terrace. The district of Gornji Ključ consists of hilly and mountainous terrain (Support Program for the Implementation of Agricultural and Rural Development Policy for the Municipality of Kladovo in 2020). In the municipality of Kladovo during 2015, 19,532 inhabitants were estimated (as of June 30, 2015), so we conclude that Kladovo belongs to the group of smaller municipalities with an average population density of 31 inhabitants / km2 (Municipalities and regions of the Republic of Serbia 2016).

Economic position of the Municipality. The participation of small and medium enterprises and entrepreneurs, as well as economic entities in the tourism sector, significantly contributes to the economic development of the municipality of Kladovo. In 2018, 161 companies and 484 entrepreneurs were operating on the territory of the municipality (Support Program for the Implementation of Agricultural and Rural Development Policy for the Municipality of Kladovo in 2020).

Importance of agriculture for the Municipality. The municipality of Kladovo is a remarkably agrarian area due to the high share of agricultural area at its disposal. Therefore, we can say that agriculture ranks high in the further development of the municipality's economy. During 2018, the utilized agricultural area (UAA) on the territory of the municipality amounted to 12,165 ha, which is 61.7% of the total available area. Of the total UAA, even 60.9% are arable land and gardens, while 35.1% are meadows and pastures. The remaining share in the structure of the UAA belonged to perennial plantations with 3%, while about 2% are kitchen gardens and fallow land (Farm structure survey 2018, eletronic database). So, we notice that the agricultural production of the municipality of Kladovo is based on crop farming, and in a very small percentage on fruit plantations, vineyards and vegetables growing.

The livestock in the municipality of Kladovo is insufficient, and livestock as a branch of agriculture is no longer dominant. Farmers are mostly engaged in cattle breeding within family holdings in the hilly and mountainous areas of the Municipality, while in the plains there are no more. Accordingly, in the area of the municipality of Kladovo, a constant decrease in livestock was observed, and possible causes are unstable prices of cattle, low purchase price of milk, high prices of animal feed and the like.

The circumstances in plant production and livestock production shows that the Municipality is inattentive to agriculture, which has contributed to its unfavorable position. The unfavorable position in agriculture is also affected by the poor situation in the economy of the municipality of Kladovo, and two possible causes have been identified. First, the reduced participation of industry in creating economic growth and development of the Municipality. Second, the structure of the economy is determined by natural and physical resources with the neglect of capital resources.

Since the structure of the municipality's economy is not diversified, Kladovo has a significantly lower level of economic development, which is why in 2016 it was classified in the third group of underdeveloped municipalities (Regulation on establishing a single list of development of the region and local self-government units for 2014). According

to this Regulation, the third group of underdeveloped municipalities includes those with a level of economic development that ranges from 60% to 80% of the national average. Therefore, it can be concluded that the municipality of Kladovo belongs to the economically underdeveloped areas of our country, which is certainly not favorable from the aspect of sustainable development. Observing the level of agriculture, the reasons for this economic situation are unfavorable working conditions associated with extensive land cultivation, fragmentation of land, outdated machinery and lack of financial resources for its modernization.

Although only bad indicators of economic and agricultural development have been mentioned before, we notice that the Municipality is outstanding for attracting investments in the field of renewable energy sources. The strategic national project of the hydroelectric power plant "Đerdap I", the use of solar energy in the solar park "Solaris Energy" and the use of energy from biomass in the pellet factory are remarkable.

In general, due to the large fragmentation of land, underdeveloped infrastructure, low investment and difficult life and work in rural areas, there have been numerous problems in dealing with this activity, which reduces the importance of this activity.

Financial support for agriculture from the budget of the municipality of Kladovo. In accordance with the Article 13 of the Law on Incentives in Agriculture and Rural Development (Official Gazette of the RS, No. 10/2013, 142/2014, 103/2015 and 101/2016), the authorities of the LSU are given the opportunity to determine support measures for the implementation of agricultural policy and rural development policy on their territory, where funds must be provided in their budgets. The mentioned Law article points out that LSU cannot determine incentives for direct payments, except for regress for costs of storage in public warehouses and for artificial insemination. The essence of this policy of support to farmers is to avoid double funding of measures.

Accordingly, we will analyze the budget of the Municipality, which shows the funds provided for agriculture and rural development. The data are contained in the municipal documents that must be harmonized with each other, namely the Decision on the Budget of the Municipality of Kladovo and the Support Program for the Implementation of Agricultural and Rural Development Policy. The mentioned documents are adopted by the Municipality every year.

The Decision on the Budget of the municipality of Kladovo for 2020 (Official Gazette of the municipality of Kladovo, No. 16/2019, 2/2020 and 6/2020) for *Program 5 Agriculture and Rural Development* allocated EUR 149,688 (average exchange rate of the National Bank of Serbia for 2020 was RSD 117.5777 for 1 EUR) for the implementation of the following activities:

1) support for the implementation of agricultural policy in the local community in the amount of EUR 132,678;

2) support measures of rural development in the amount of EUR 17,010, while in the total budget of the LSU it has a share of 2.34%.

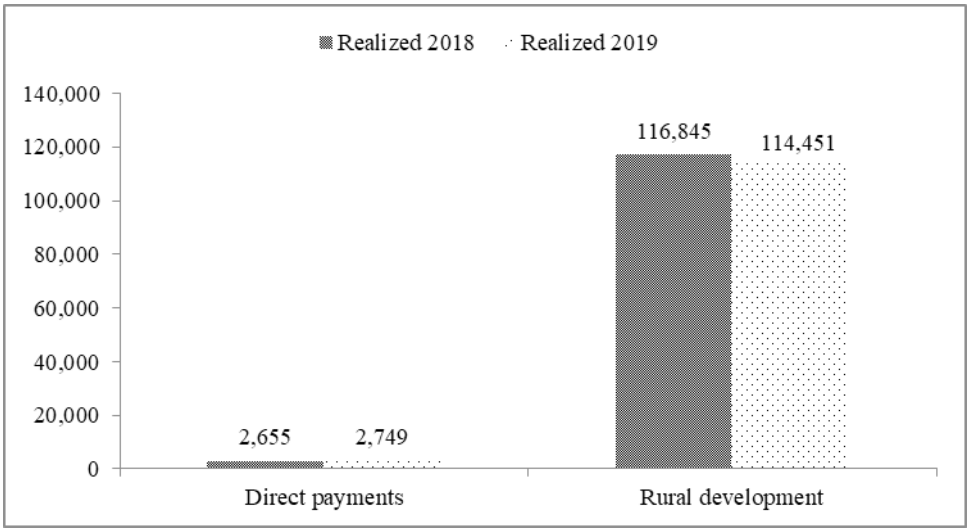
Each year, the Municipality of Kladovo adopts *the Support Program for the Implementation of Agricultural and Rural Development Policy*, which is in accordance with the planned funds in the budget. The support measures contained in the programs are intended for registered agricultural holdings, and they are in active status in the Register of Agricultural Holdings. Figure 1 shows the spent budget funds of the Municipality provided by this Program during 2018 and 2019 (the average exchange rate of the National Bank of Serbia for 2018 was RSD 118.2716, and for 2019 it was RSD 117.8524 for 1 EUR).

The graphic review (Figure. 1) shows that during 2018 and 2019, no funds were paid from the municipal budget for the measure of credit support and special incentives, because no cash benefits are provided for these purposes.

When it comes to direct payment measures, the artificial insemination of cows is highlighted as necessary in the aim of the recovery of livestock production, but also because of direct impact which have been achieving on the development and stability of total agricultural production of households (Support program for the implementation of agricultural and rural development policy for the municipality of Kladovo in 2020).

According to the Report on implemented measures of agricultural policy and rural development policy for the municipality of Kladovo in 2018, a total of EUR 119,500 was paid from the municipal budget (Figure. 1), with most funds allocated for the purchase of beekeeping equipment almost EUR 25,365.

Figure 1. Realized budget funds Municipality of Kladovo planned with Support Program for the Implementation of Agricultural and Rural Development Policy (2018-2019, in EUR)



Source: Report on implemented measures of agricultural policy and rural development policy for the municipality of Kladovo, 2018 and 2019

The Report on implemented measures of agricultural policy and rural development policy for the municipality of Kladovo for 2019 records a total decrease in paid value compared to 2018 and amounts to 117,200, and the structure of paid funds is dominated by funds for investments in physical assets of agricultural holdings (EUR 98,428).

For 2020, the total planned funds of the municipality of Kladovo for the development of agriculture and rural development were EUR 120,771, and 95% of these funds are provided for rural development measures.

The implementation of the Program of Support Measures contributes to the stability of income of agricultural producers, encourages self-employment and employment, reduces producer costs and increases the productivity and efficiency of agricultural holdings.

The municipal budget also generates certain incomes from the rent of agricultural area being in the state property of the Republic of Serbia. The funds collected in this way have precise purposes, with most of the funds allocated to the arrangement of agricultural area (consolidation of agricultural area, arrangement of rural roads and equipping the anti-hail service). Accordingly, out of 7,126.6 ha of agricultural area that are in the state property, about 14.4% or 1,023 ha are under valid rent contracts (Annual program of protection, arrangement and use of agricultural area in the municipality of Kladovo for 2020).

The previous analysis of the budget support of the Municipality intended for agriculture and rural development shows that the support for agricultural production and processing changes from year to year, both in total value and by individual types of incentives.

Additional sources of funding. Data from the 2012 Census of Agriculture (http://popispoljoprivrede.stat.rs/?page_id=6221) show that in Kladovo, about 0.7% of the total number of agricultural holdings used *bank loans* to finance agricultural production (only 16), which is below the national average (which was 2.9%). We conclude that the current situation is deficient considering the bad credit conditions, and dealing with the repayment deadlines, high interest rates, unfavorable credit security conditions and the like.

Since the municipality of Kladovo disregards funds in its budget to subsidize the interest rate on agricultural loans approved by commercial banks, the recovery of agriculture will be difficult and gradual.

Concerning *donations*, during 2014, the municipality of Kladovo received a donation from the Turkish International Development Agency (TIKA), which consisted of 20 greenhouses. During 2015, the FAO organization gave a donation in the form of aid to goods and animals to agricultural holdings affected by the floods. More precisely, seed material, fertilizer, fodder, fruit seedlings, greenhouses, attachment units, beehives, cattle and sheep were donated. Residents of the district of Donji Ključ, who were not affected by the flood, donated bulky food for cattle from their own production for the most endangered settlements from the territory of the Municipality. The Department of Economy, Social Affairs and Local Economic Development of the Municipality has no information on realized donations after 2015.

Conclusions

Agricultural production is significant for Serbia, considering it has a high share in the creation of the country's GDP, even higher than some countries in the region that are members of the EU. Therefore, agro-economic policy should be adjusted to real possibilities and opportunities in order to keep the existing population in the countryside and motivate them to continue with agricultural production.

The paper mentioned that the municipality of Kladovo belongs to economically underdeveloped districts, which is inadequate from the aspect of sustainable agricultural development. In order to improve the situation, it is recommended to conduct the consolidation of holdings, renewal of mechanization and greater financial support to registered agricultural holdings that are actively engaged in agriculture. Another recommendation could be greater availability of advisory services to more agricultural producers.

Considering that the Municipality allocates certain funds in its budget for assistance to agricultural producers, we conclude that they are not enough, which leads agricultural producers to leave this activity.

We know that agriculture in Serbia and the municipality of Kladovo is the framework of further development of the entire economy, because it provides raw materials for all other activities. Apparently, further development of agriculture should focus on:

- increase the agrarian budget;
- knowledge and innovation, using modern achievements in the field of science and technology;
- specialization of production;
- consolidation of holdings, in order to raise the quality and scope of production activities to a higher level;
- processing of agricultural products of a higher degree of finalization, etc.

In general, agriculture in Serbia is a significant activity and can contribute to a better standard of living for the population for whom agriculture is the only source of income. However, the number of agricultural producers is decreasing because agriculture requires constant financial investments and requires certain risks, such as placement, collection of receivables, etc.

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Conflict of interests

The authors declare no conflict of interest.

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THE DETERMINANTS OF GROWING AGRI-FOOD EXPORT: THE CASE OF CEE COUNTRIES

Suzana Balaban [1], Marijana Joksimović[2], Bojan Stoiljkovic[3]

**Corresponding author E-mail: joksimovicmarijana80@gmail.com*

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ABSTRACT

The aim of this study is to analyse the determinants of the growing agri-food export in the CEE countries. Using the SYS-GMM estimation, we control for the endogeneity problem. As the explanatory variables we use the variable that have been empirically proven as determinants of the agri-food export and available for observed countries. The obtained results show that the trade liberalisation increases the agri-food exports, while the EU enlargement indirectly affects the agri-food exports which is an important statement for policy-makers.

Introduction

Despite the fact that the share of the agri-food export in total merchandise export has been declining, food is still an important element of world trade. The current food trade pattern has been broadly dictated by developed countries. However, the role of transition countries has been increasing. Consider the constant growth of the agri-food export, the CEE countries may become major agri-food exporters in Europe. On this subject, Tangermann (1994) highlights two vital factors; the improvement of product quality using the new production technologies, and a growth in the quantity of exports as a consequence of trade liberalization.

1 Suzana Balaban, Assistant Professor, Alfa BK University, Faculty of Finance, Banking and Auditing – Belgrade, Serbia, E-mail: suzana.balaban@alfa.edu.rs, ORCID ID (https://orcid.org/0000-0001-8132-9120)

2 Marijana Joksimović, Alfa BK University, Faculty of Finances, Banking and Auditing , Belgrade, Serbia, Email: joksimovicmarijana80@gmail.com, Phone: 0648708947, ORCID ID (https://orcid.org/0000-0002-5939-5137)

3 Bojan Stoiljkovic, Alfa BK University, Faculty of Finances, Banking and Auditing, Belgrade, Serbia Email: bojan.stoiljkovic@alfa.edu.rs, ORCID ID https://orcid.org/0000-0003-2796-8663

The agricultural sector of the most of CEE countries has been broadly underdeveloped, consider production for the domestic as well as foreign market. In the Western Balkan (WB) countries the value added (VA) in agriculture is still twice higher than the VA in manufacturing of food and beverage (F&B). The experience of CEE countries reveals that production, price and trade significantly change after the EU enlargement as well as during the pre-accession period (Mizik and Meyers, 2013). The agri-food export has been continuously increasing. However, an inability to meet certain standards for quality and safe agri-food products, underdeveloped infrastructure and lack of capacity slows down their integration into global markets.

The export-led growth from agriculture may provide optimal resource allocation for CEE countries that have a comparative advantage in the agri-food production. In these countries the agri-food export become a generator of growth. The main objective of this paper is to investigate the agri-food export determinants in CEE countries, which included each of the following aims:

- to review the theory and evidence regarding the determinants of the agri-food export,
- to analyse the agri-food sector in the observed countries,
- to answer the question whether EU accession as well as other determinants affect the agri-food export,
- to discuss political implications.

We assume that the EU enlargement directly or indirectly affect the agri-food export of observed countries. The paper is structured as follows. Section 1 presents the literature survey on the agri-food determinants. The brief characteristics of the agri-food sector in CEE countries are shown in Section 2. The underlying model and data set are presented in Sections 3. Section 4 explains the used methodology and empirical results, while Section 5 concludes.

Literature review

The literature emphasizes foreign income as the most important determinant of international trade (Baiardi et al., 2015). GDP per capita of EU as the largest importer has been increasing. Ševela (2002) show that the trade between the countries depend on the strength of both economies and closeness of the economies. To analyse the impact of closeness of the economies, we employ a variable that measure the economic distance, while as a proxy of the strength of economy we use a gross production index.

Luckstead and Devadoss (2019) argue that trade liberalisation increases the agri-food exports. We can say that for CEE countries the EU accession leads to the expected liberalization. Bielik et al. (2013) notice that the EU enlargement influenced the

structure of Czech and Slovak agricultural trade. Smutka et al. (2016) show that after the EU accession an increase in the agri-food trade of the Czech Republic be achieved by the growth in the prices as well as by the greater share of the semi-processed and finalized products. The Western Balkan (WB) countries mainly export raw materials and semi-processed products. To answer the question whether trade liberalization and the EU membership affect the agri-food export, we employ three variables; the openness, export structure and EU dummy.

Following Arize et al. (2000) there is no consensus reached in a theory about an influence of the exchange rate (EXR) volatility on the international agri-food trade. Kandilov (2008) shows a significant negative relationship between the EXR volatility and trade flows especially in the agricultural sector. Erdem (2010) finds that high level of the EXR uncertainty implies smaller agricultural trade volumes. We measure the effect of the true EXR uncertainty on the agri-food export.

Considering the issue of prices, we may say that the lower price elasticity is associated only with processed goods (Baiardi et al., 2015). Unfortunately, for the observed countries there is no available data on prices for certain products, hence we use an aggregate price index.

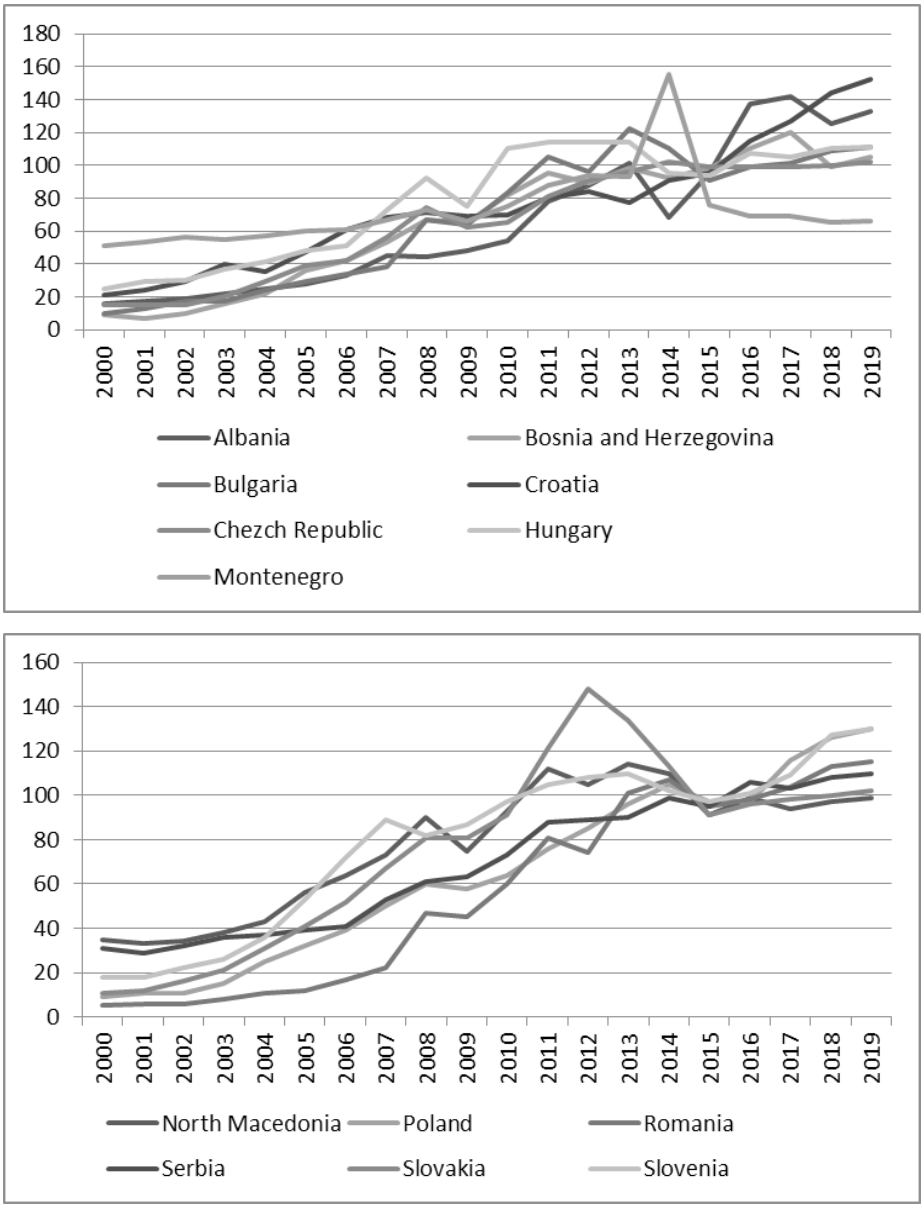
Innovation may affect the level of trade in several ways. Ghazalian and Furtan (2007) conclude that R&D increases the agri-food exports. Unfortunately, there are no available data of R&D capital stock for the observed countries, hence we use labour productivity as a proxy for innovation.

Earlier studies have argued that only the largest and the most efficient companies are capable of exporting. However, the experience shows that a large number of SMEs are also involved in internationalization. Therefore, we did not include the number of enterprises in agribusiness as a determinant of the model.

Brief characteristics of agri-food sector in CEE countries

The CEE countries are relatively small economies, which when taken together constitute an important market. Agribusiness, the sector that already existing favourable climate and long tradition, as well as a wealth of various types of arable land, has been additionally improved by the market opening; the openness index arises from 67.9% in 2000. to 131.2% in 2020.

Figure 1. Agri-food export value index (2014-2016=100)



Source: FAO Statistics Division

All countries we observed (see Table 1) were socialist states, belong(ed) to the group of transition countries, are the EU members or candidates and have experienced a similar agri-food export patterns (see Figure 1). According to the latest available World bank data the food exports share of total merchandise export for obtained countries was 9,9%; the lowest in Slovenia (4%), the highest in Serbia (19%). Although all observed countries

have experienced GDP per capita growth, the economic distance between them and Germany as the most developed EU country is still large and continues to growth.

Table 1. Export structure, economic distance and consumer price since 2000.

Country	VA in agriculture / VA in manuf.of F&B		Economic Distance*		Consumer prices, food indices	
	2000	2019	2000	2019	2000	2019
Albania	6.16	3.08	32 796	39 500	62.8	113.5
Bosnia and Herzegovina	4.45	1.76	31 910	38 899	71.0	101.1
Bulgaria	6.08	1.55	30 989	36 000	58.9	114.4
Croatia	1.25	0.88	25 925	30 853	73.6	104.3
Czech Republic	0.84	0.77	22 510	24 216	74.9	110.9
Hungary	1.28	1.74	25 766	29 216	49.1	114.6
Montenegro	5.21	5.22	30 369	36 550	75.5	104.9
North Macedonia	3.35	3.31	31 467	38 732	74.9	100.9
Poland	0.93	0.77	27 473	29 216	71.4	115.8
Romania	1.69	1.38	30 146	33 177	85.6	110.1
Serbia	2.65	1.49	31 587	37 483	28.3	107.1
Slovakia	0.71	1.55	25 846	25 997	70.5	109.6
Slovenia	1.17	1.04	18 499	20 427	66.2	110.1

**Calculated in 2010 constant EUR . Source: own calculation based on FAO Statistics*

Following Grujić et al. (2019) the high share of the higher processing agri-food products leads to an increasing value of surplus in balance of payments. After the EU enlargement, the countries have been experienced growth of the agri-food exports achieved by the growth in the prices as well as by the greater share of the semi-processed and finalized products in the total agri-food export. To examine the agri-food export strucutre, we compare the VA in agriculture with VA in manufacture of F&B for each observed country. It would be desirable that this coefficient be less than one, which means that there is a high degree of processing food. However, the most of observed countries have a coefficient greater than one, except Croatia, the Czech Republic and Poland. The WB countries are in an unfavourable position relative to new EU members; mainly exporting raw materials and semi-processed products. When we compare the agriculture VA per worker, we may say that the Czech Republic, Slovakia, Hungary and Slovenia are the most productive countries, while the lower productivity per worker is recorded in Albania, Serbia and Romania. The food prices have been increasing in all observed countries.

Model and data

In order to analyse the determinants of the agri-food exports, we employ the following model:

$$y\_(i,t)=\beta y\_(i,t-1)+\theta\text{^'} (L)\, x\_(i,t)+\gamma\_t+\alpha\_i+\varepsilon\_(i,t) \quad (1)$$

for

$$i=1,\ldots,N \text{ and } t=q+1,\ldots,T$$

where y_(i,t) is the food export of country i at time t, x_(i,t) is a vector of the explanatory variables, θ(L) is a vector of associated polynomials in the lag operator, q is the maximum lag length, γ_t stands for the time-specific effect, α_i is an unobserved country-specific effect, and ε_(i,t) is the white error term. As the explanatory variables we use the variable that have been empirically proven as determinants of the agri-food export, available for observed countries. All variables are annual and transformed into a natural logarithm covering the period 2000-2019.

Export value index is used as a proxy for dependent variable. Value indices represent the change in the current values of export from the country i in year t. Gross production index is used as a proxy for supply of the country i in year t. The openness index is calculated by taking the sum of import and export divided by total GDP of the country i in year t. As the measures of closeness of the economies we employ the economic distance variable that we calculate as a difference between GDPpc of Germany and the country i in year t. The economic distance is a proxy for difference in economic development.

Table 2. The determinants of agri-food export

Variable	Sign	Source
Export value index from the previous period Gross production index (2014 – 2016 = 100)	(+) (+)	FAO Statistics FAO Statistics
$\text{Openness} = \frac{\text{Export} + \text{Import}}{\text{GDP}}$	(+)	WordBank Data
Economic distance = GDPpc of Germany – GDPpc of country *i*	(-)	WordBank Data
$\text{Export structure} = \frac{\text{VA in Agriculture}}{\text{VA Manufacture of F\&}B}$	(-)	FAO Statistics
Consumer price	(-)	FAO Statistics
Productivity	(+)	FAO Statistics
EXR volatility	(-)	WordBank Data
EU Dummy	(+)	Europa.EU

Source: own calculation based on FAO Statistics

As a measure of the export structure we use coefficient that compare the VA in agriculture with VA in manufacture of F&B. The lower coefficient means that there is a high degree of processing food. The EXR volatility is measured by the conditional variance of the monthly real EXR derived from a GARCH (1,1) model as proposed by Balaban et al. (2019). As a measure of price level we use consumer prices, food indices (2015=100). An agriculture VA per worker is used as a measure of productivity. Consider that EU enlargement leads to the expected liberalization, we employ a dummy that takes the value 1 in the case that observed country is the EU member, and 0 for another. We expect that the coefficient of a dummy variable would be significant. The expected signs of all variable are presented in Table 2.

Methodology and results

Eq. (1) accounts for dynamic effects because of the first explanatory variable; the lagged value of dependent variable. However, in both fixed and random effects settings, a main problem arises from the fact that the lagged dependent variable is correlated with the disturbance. To ensure the reliability and consistency of our results, we employ instrumental variables within the SYS-GMM estimation procedure (Blundell and Bond, 1998). With this approach, every regressor is instrumented, including both the level and first difference equations in a stacked system, which allows to overcome potential issues of endogeneity bias. A relatively small number of observations do not seem to have important effects on the properties of the SYS-GMM estimator; when series are persistent, the estimator shows the lowest bias and highest precision.

Table 3. CIPS Panel Unit Root Tests in Panel Data

Variable	Statistics
Agri-food export	-1.9427**
Gross Production Index	-1.6128*
Openness index	-1.6894*
Economic distance	-2.1702**
Export structures	-1.8038*
EXR volatility	-3.0417*
Consumer prices	-2.1652**
Productivity	-1.6011*

Note: * $p < 0.05$ **$p < 0.01$ *** $p < 0.001$. According to obtained results we may reject accept H1: stationarity The CIPS test is based on individual CADF regressions with l=2 lags of differences including an intercept only. The outcomes are not very sensitive to the choice of the number of lagged differences l.

Source: own calculation, R

In the case when T>N, we should consider a problem of stationarity. To determine which generation of unit root test we perform two cross-section dependence tests; Breusch – Pagan LM and Pesaran CD tests (the results are available on request). The results of the applied tests indicate significant cross-sectional dependence. Consequently, we apply the second generation panel unit root tests that allow for cross-sectional dependence, proposed by Pesaran (2007). On the basis of the common unobserved factor assumption for the error process, the CIPS test indicates the stationarity of all observed variables (see Table 3). Then, we apply the SYS-GMM methodology on Eq. (1) (see Table 4).

Table 4. Determinants of agri-food export – SYS-GMM methodology

Variable	Statistics
Agri-food export(-1)	0.844890***
Gross Production Index	0.442575
Openness index	0.839936*
Economic distance	-3.637718
Export structure	-0.285064

Variable	Statistics
Volatility	-0.007401
Consumer prices	0.659988
Productivity	0.481683
EU dummy	0.105747
Diagnostic tests:	
Root MSE	0.108543
Sargan	6.387498
AR(2)	-0.062719

Note: Sargan test examine over-identifying restrictions, root MSE measures the differences between values estimated by a model and the values observed, AR test confirms the absence of serial correlation. Sargan test has a null hypothesis (Ho): The Instruments as a group are exogenous. The higher the p-value of Sargan statistic the better. It is recommended that sargan p-value should be greater than 0.25.

Source: own calculation, Eviews 11

Based on the obtained results, we can say that the expected signs for all observed variables were achieved. However, only a few variable are statistically significant; the agri-food export from previous period, openness and economic distance. The model works well in several diagnostic dimensions.

Conclusions

In observed CEE countries the agri-food export has been constantly growing since 2000. The literature emphasizes foreign income as a crucial determinant of trade in general. Available data show that GDP per capita of EU have been increasing. Bearing in mind that the export market is almost the same for all observed country, we did not include a variable that measure GDP per capita in the model.

The economies of the CEE countries are relatively small economies, which when taken together constitute an important market. Agribusiness, the sector that already existing favourable climate, long tradition, and has been additionally improved by the market opening. The most authors consider that trade liberalisation increases the agri-food exports. Our results may confirm this fact; openness is significant variable that positively affects the agri-food export in observed economies. For policy makers this fact may be interpreted as a demand for further liberalization that should leads to specialisation in certain industries depending on the relative factor endowments.

We expect that the EU enlargement leads to necessary liberalization in the WB countries changing the agri-food export structure including a higher share of semi-processed and finalized products. According to our results the EU dummy variable is not statistically significant, that means that the EU accession does not affect the agri-food export. However, we should be careful with this statement. We may only conclude that the EU membership has no effect on the value of the agri-food exports in observed countries. According to available data, the new EU members have better agri-food structure than

the WB countries and are economically closer to the most developed EU members. Taking into account that the economic distance of observed countries as a proxy of reverse economic "closeness" has a negative impact on the value of the agri-food export we may draw a conclusion that the EU accession indirectly affects the agri-food exports which is an important statement for economic policy-makers.

Other variables do not affect the agri-food export; supply of observed country measured by gross production index, export structure, the "true" EXR uncertainty; consumer price, and productivity.

As a limit of this research we state the possibility of occurrence an aggregate bias. Accordingly, for further research, we suggest using a disaggregated level of exports as a dependent variable.

Conflict of interests

The authors declare no conflict of interest.

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STATS OF FISHERIES AND DISEASE CONTROL IN THE REPUBLIC OF NORTH MACEDONIA IN THE ERLY 21th CENTERY

Aleksandar Trajchovski[1], Misho Hristovski[2]

**Corresponding author E-mail: aleksandar.trajchovski@fvm.ukim.edu.mk*

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ABSTRACT

This review aims to show the current state of fisheries in the Republic of Northern Macedonia as well as the strategy for the prevention and control of World Organization for Animal Health (OIE) notifiable diseases in aquaculture in order to comply with European legislation. At the moment, Macedonia produces about 1,700 tons, which dominates the production of trout with 63% and carp with about 29% of the total production. This sector has had a constant. Positive growth in recent years, attracting new investors, especially in cold-water aquaculture. Although the consummation of 5 kg per capita of fish is modest, domestic production does not satisfy their needs, so the market is supplemented with fish imports. One of the conditions for this sector to continue to grow at such a pace is to limit losses in aquaculture production. The most serious limitation that serious producers deal with is the appearance of infectious diseases.

Introduction

Aquaculture in the Republic of North Macedonia dates back to the early thirties of the last century. The endemic species of trout Salmo letnica Karaman was originally bred for stocking Lake Ohrid and population maintenance. After World War II, rainbow trout farms (Oncorhynchus mykiss) were built in many places with a total capacity of about 300 tons. Carp farms were also established in the 1950s and raised in ponds. In the late 1970s and early 1980s, cage breeding of rainbow trout and carp began in some of the irrigation lakes. In the late 1980s, polyculture began to be introduced by introducing Asian fish species such as grass carp (Ctenopharyngodon idellus), silver carp (Hypophthalmichthys molitrix), and bigheaded carp (Hypophthalobic). Experiments were also conducted to breed warm-water fish in rice fields, but without success. By the end of the 1980s,

1 Aleksandar Trajchovski, DVM, Faculty of Veterinary Medicine, Lazar Pop Trajkov 5-7, Skopje, North Macedonia, E-mail: aleksandar.trajchovski@fvm.ukim.edu.mk, ORCID ID (https://orcid.org/0000-0002-9891-6345)

2 Misho Hristovski, full professor, Faculty of Veterinary Medicine, Lazar Pop Trajkov 5-7, Skopje, North Macedonia, E-mail: hristovskim@fvm.ukim.edu.mk, ORCID ID (https://orcid.org/0000-0003-2340-6188)

the entire aquaculture sector was state-owned. The aquaculture sector is now privately owned. Unfortunately, large farms producing hot-water fish are drastically reduced. The production of rainbow trout and its albino forms is dominant. In the physical plan of the Republic of North Macedonia for the period 2002-2020 is expected to increase fish production from 989 tons to 2,300 tons (. Introduction is the first section of an IMRAD paper. It purposes is to state clearly the problem investigated and to provide the reader with relevant background information. State the objectives of the work and provide an adequate background, avoiding a detailed literature survey or a summary of the results.

Materials and methods

Articles, newsletters, annual reports, forecasts and other official materials from various authors were used for this research, including institutions such as the Ministry of Agriculture, Forestry and Water Management (MAFWM), the Food and Veterinary Agency (FVA) and the State Statistics Office of the Republic of North Macedonia. Additional information on fish production has been collected by various authors, while some have been collected during fish market visits in 2020 as a joint activity of the Faculty of Veterinary Medicine -Skopje (FVMS) and the Food and Veterinary Agency as part of the national program for monitoring viral diseases in aquaculture.

Results and discussion

In the Republic of Northern Macedonia, fishing is performed on all fishing waters within and under conditions determined by law. Fishing waters in Macedonia cover about 56,000 hectares, of which 83% are fishing areas including natural lakes (Ohrid, Prespa and Dojran), 11% are fishing zones and recreational zones on artificial lakes, 4% are fishing areas - rivers. Within these 56,000 ha, 1% are aquaculture facilities where fish are raised. Social and political changes in Macedonia have led to negative consequences in this sector, which has resulted in minimizing the role of the sector in the overall economy (Annual Report on Agriculture and Rural Development (2001-2019)). However, the importance of the sector and its potential for the development of rural tourism and aquaculture production, as well as the social and environmental roles in a balanced and diverse agricultural and rural development policy, should not be underestimated. From the aspect of the national economy, fisheries has an imperceptible share in GDP of only about 0.1% (Annual Report on Agriculture and Rural Development (2001-2019)). Outdoor fishing can be commercial, recreational, and selective, land reclamation and fishing for scientific research purposes. Commercial fishing is carried out on fishing areas and fishing zones, recreational fishing is organized on fishing grounds and recreational zones, and selective, land reclamation and fishing for scientific research purposes are performed on all fishing waters with previously obtained approvals and permits. Aquaculture (fish farming) is done in fishing facilities (full-systemic fish farm and semi-systemic fish farms) which are registered in the ministry. Commercial fishing in fishing areas has been steadily declining in the past. This is due to the reduction of the stock of some important fish species which led to the adoption of bans on their commercial fishing. Unlike commercial fishing in open

fishing waters, fish production in aquaculture has been growing steadily in recent years. In aquaculture, most of the production is related to rainbow trout and carp. Concrete fish farms are predominate in the production facilities for cold water aquaculture and there are also several farms with cage breeding of trout, while for warm water aquaculture the cage breeding of artificial lakes predominantly on Lake Tikvesh. The hot water polyculture with more serious capacities is available in two locations in the country, and the other fish farms are on artificial lakes - small dams - ponds with small production capacity.

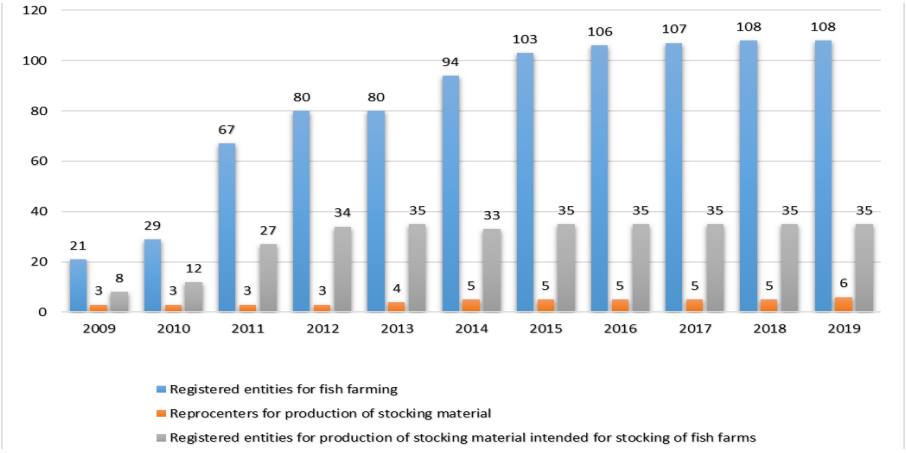
Currently, according to the State Statistics Office of the Republic of North Macedonia, there are 108 aquaculture farms, of which 52 are cold-water fish farms and 46 are hot-water fish farms (20 of which are cage farms) and 9 combined farms. Out of 108 farms, only 35 produce offspring for their own needs, also they sell to other fish farms. In Macedonia we also import fertilized eggs and offspring to meet the needs. And for stocking the waters with indigenous species, 6 repro-centers have been registered: 2 for hot water species, 1 for cold water and 3 combined.

Table 1. Fish farms divided by production capacity

Type of fish	Registered capacity				Total number
	< 20 t	20-50 t	50-100 t	> 100 t	
Trout	33	10	7	3	53
Carp in cages	15	7	3	1	26
Carp in fishponds	17	1	2	-	20
Combined	6	3	-	-	9
Total	71	21	12	4	108

Source: Annual Report on Agriculture and Rural Development (2001-2019). Ministry of agriculture, forestry and water management

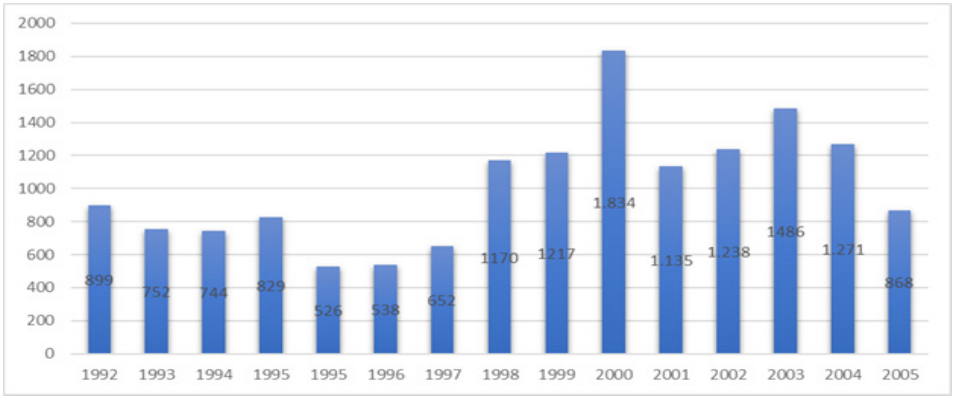
Figure 1. Number of registered entities for fish production



Source: Annual Report on Agriculture and Rural Development (2001-2019). Ministry of agriculture, forestry and water management

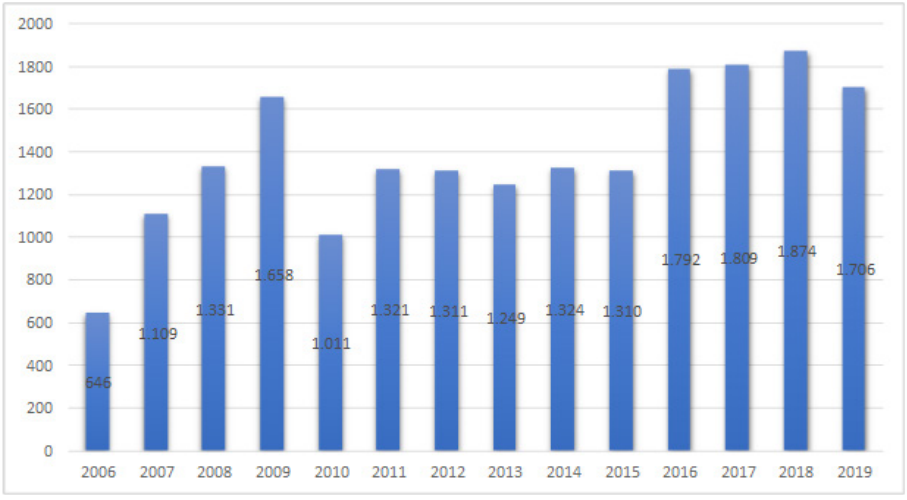
Although the number of breeders has a positive growth in the last 10 years, the production in aquaculture does not have a constant increase and there are many variations. From the 1990s until 2020, it has almost doubled, which is a good sign, although the projected 2300 (Annual Report on Agriculture and Rural Development (2001-2019)) tons have not been exceeded

Figure 2. Total production capacity 1992-2005 in tons



Source: Annual Report on Agriculture and Rural Development (2001-2019). Ministry of agriculture, forestry and water management

Figure 3. Total production capacity 2006-2019 in tons



Source: Annual Report on Agriculture and Rural Development (2001-2019). Ministry of agriculture, forestry and water management

Most of the fish production in Macedonia belongs to the cold water aquaculture with the most dominant species of rainbow trout (Oncorhynchus mykiss) and significantly

smaller amount of river trout (Salmo farioides), Macedonian trout (Salmo Macedonicus) Ohrid salmon (Salmo letnica Karaman), Brook trout (Salvelinus fontinalis). In the warm-water aquaculture, the production of carp (Cyprinus carpio) is dominant and besides carp, grass carp (Ctenopharingodon idella), silver carp (Hypophthalmichthys molitrix), bigheaded carp (hypophthalmichthys nobilis) are also grown. In addition to trout and carp, commercial eel (Anguilla anguilla), red fin (Rutilus rutilus), whitefish (Salmo ohridanus), perch (Perca fluviatilis) and others are caught as important economic species.

Table 2. Fish production in North Macedonia in tons

Species	Year									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Trout	646	837	829	782	834	963	1128	1128	1156	1132
Carp	342	455	417	348	355	405	514	589	614	524
Catfish	10	14	6	9	5	0.5	3	5	6	2
Eel	/	/	3	4	4	0.8	0.9	0.9	0.4	0.4
Other species	13	26	56	107	124	106	131	85	98	47

Source: Annual Report on Agriculture and Rural Development (2001-2019). Ministry of agriculture, forestry and water management

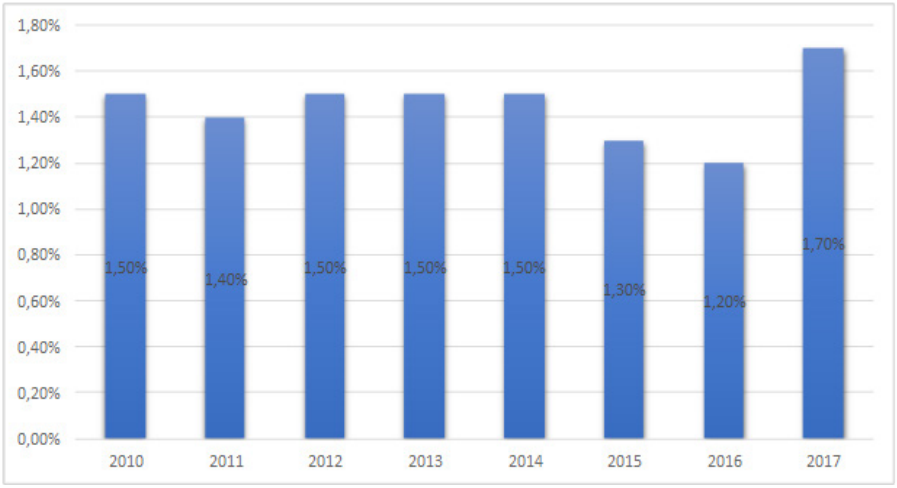
Consumption and import of fish

According to the official statistics of the State Statistics Office of the Republic of North Macedonia, the average household in Macedonia consumes about 21 kg fish and fish products per year or about 5 kg per capita (Annual Report on Agriculture and Rural Development (2001-2019)). Consumption of fish in 2005 was 3.5 kg per capita Hristovski et al.,2005), where there is an increase but still not enough compared to the world average of 15-20 kg per capita (Annual Report on Agriculture and Rural Development (2001-2019)).

The trade of fish products reflects Macedonia's dependence on marine fish and fish products given that the country has no access to the sea. The share of the import from the European Union of these products in the total import of agro-food products in the period from 2010-2017 ranges from 1.2% to 1.7%, i.e. on average 1.45% (Annual Report on Agriculture and Rural Development (2001-2019)).

The majority of imported fish and fish products are frozen fish with about 50% of the total value of imports; then canned fish (whole or in portions) by about 38%; and fresh fish by about 6%. The remaining 6% consists of fish fillets, mussels, mollusks, smoked fish and caviar. Most of the value of imported fish products were imported from Argentina (23.2%), Croatia and Spain (each with 10%), Greece (5.5%), followed by Bulgaria, Serbia and Montenegro (Annual Report on Agriculture and Rural Development (2001-2019)).

Figure 4. Share of fish import and fish processing from the total import of agri-food and fish production



Source: Annual Report on Agriculture and Rural Development (2001-2019). Ministry of agriculture, forestry and water management

The reasons why Macedonia has low consumption of fish is lack of habit and tradition to consume fish, seasonal fishing nature, lack of well-organized infrastructure in the market for fish and fish products, high prices of fish products compared to living standards; high prices of imported fish products in relation to the average income of the population. The increase in fish consumption is due to the development of rural tourism and the construction of so-called ethno-complexes and fish restaurants that promote fresh natural food.

Financial support program in fisheries

Ministry of Agriculture, Forestry and Water Management has implemented a "Program for financial support of fisheries and aquaculture" in order to protect the aquatic flora and fauna, investments in aquaculture, technical assistance for the development of new markets and promotional campaigns. For the realization of the envisaged measures in the program, the funds are allocated from the budget of the Republic of Northern Macedonia (Approximately 1.500.000 euros for 2021). The funds in the program are mostly intended for investments in fisheries and aquaculture and provision of stocking material for production fishing facilities (54%), for protection of aquatic flora and fauna about 14% and about 4% for technical assistance and development of new markets and promotional campaigns. The remaining funds are for unrealized liabilities in relation to concluded contracts and submitted requests.

Health status and disease control

The development of the aquaculture sector and the growth of intensive aquaculture production in Macedonia is followed by the development of accompanying scientific expertise with active involvement of the veterinary profession. The European Operational Model has been applied and a system for monitoring and control of fish diseases has been established at the state level in order to prevent, control and eradicate infectious fish diseases according to the standards of the World Organization for Animal Health. At the same time, appropriate legislation has been established that will regulate the problems in aquaculture in Macedonia and is in line with Europe Union directives. For the first time surveillance of diseases in aquaculture was conducted in 2015 by sending samples to the Veterinary Institute in Belgrade (Serbia) while in 2019 a national reference laboratory for viral diseases in fish was established at the Faculty of Veterinary Medicine in Skopje and actively participates in proficiency testing conducted by the European Reference Fish Laboratory in Copenhagen, Denmark.

According to the annual order for animal health protection, infectious diseases in aquaculture are prescribed for which active supervision is carried out, in salmonide: viral hemorrhagic septicemia (VHSV), infectious hematopoietic necrosis (IHNV), infectious necrotic pancreatitis (IPNV) and bacterial kidney disease (BKD). In cyprinid species of fish: Koi herpes virus (KHV) and spring carp viremia (SVCV). In order to determine the epidemiological situation in aquaculture animals, active surveillance of fish in fishing waters will be carried out, as well as passive surveillance of aquatic animals. Due to the determination of the health status in the facilities for production of aquaculture as well as for the improvement of the level of health care of aquatic animals, the breeders of animals from aquaculture should regularly report the increased (if we have a cumulative mortality of 0.5% per week.) (Cvetkovic et al., 2020);(Law on Health Protection of Animals from Infectious Diseases).

Although there are no national programs for monitoring bacterial or parasitic diseases, data obtained from fish farms through National Referent Laboratory (NRL) cooperation with fish farms indicate sporadic cases of furunculosis and yersiniosis in salmonids and erythrodermatitis in carp. Parasites such as Ichthyophthirius multifiliis and Gyrodactylus spp. have been observed in salmonid and cyprinid in intensive production systems, but through the implementation of preventive measures in fish farms and internal control of health status, the presence of bacterial and parasitic pathogens is minimum (Boshnakovski et al., 1991); (Markic, et al.,1999); Hristovski M. et al., 2001); Hristovski N. et al., 2001); (Hristovski & Cvetkovic, 2005) ;(Cvetkovic et al., 2007); (Cvetkovic et al., 2009); (Cvetkovikj et al., 2020).

Conclusions

The geographical location as well as the natural resources that Macedonia possesses, above all the quality mountain waters, meet the criteria for intensive aquaculture cultivation, especially cold-water aquaculture. Fisheries in Macedonia has the potential

for development, although it did not reach the projected physical plan with production of 2300 tons (Annual Report on Agriculture and Rural Development (2001-2019)) in 2020, which may be a result of the early implementation of outflow treatment that increases operating costs and the issue of biodiversity protection. But the continuation of the program for financial support in fisheries is likely to continue with positive growth in aquaculture. There is also potential in increasing the production of indigenous fish species promoted by scientific institutions in the country, but producers are not so interested due to the slow growth rate. Inclusion of aquatic animals in the annual order for animal health protection is another measure that will contribute to a better insight into the health status of existing facilities as well as a potential increase in capacity and the possibility for producers to export fish or juveniles to the Europe Union.

Conflict of interests

The authors declare no conflict of interest

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AGRARIAN STRATEGY AND POLICY OF THE REPUBLIC OF SERBIA

Ratko Ljubojević[1], Andrija Blanuša[2], Slobodan Petrović[3]

**Corresponding author E-mail: ratko_ljubojevic@yahoo.com*

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ABSTRACT

The subject matter of this paper are the changes in the directions and content of the agrarian strategy and policy in the Republic of Serbia during the last two decades, which occurred primarily due to the need to adjust to the standards of the Common Agricultural Policy of the European Union. The paper starts from the assumption that the process of creating agrarian policy and its transmission to economic flows is very complex and slow and requires the activity of a large number of actors and relevant institutions. Key strategic documents in the field of agriculture as well as measures of the current agricultural policy were analyzed. The aim of the paper is to examine the compliance of current agricultural policy measures with the priorities of agricultural development that are determined by these strategic documents, and above all the Strategy of Agriculture and Rural Development of the Republic of Serbia for the period 2014-2024.

Introduction

Due to its natural characteristics of land, climate and water resources, the Republic of Serbia has the potential in the agricultural sector, which is not fully exploited. With an adequate agricultural policy, agriculture can make an additional contribution to the economic development of the country. Due to its connection and impact on other sectors of the economy, agriculture is extremely important, considering that it employs, directly or indirectly, a large number of people, participates mostly in foreign trade,

1 Ratko Ljubojević, PhD, Associate Professor, Faculty of Law, Megatrend University, Maršala Tolbuhina 8, 11070 Novi Beograd, Phone +381 63 255 125, E-mail: ratko_ljubojevic@yahoo.com, ORCID ID (https://orcid.org/0000-0002-7941-2248)

2 Andrija Blanuša, PhD, Assistant Professor, Faculty of Social Sciences, Univerity Business Academy Novi Sad, Bulevar umetnosti 2a, 11070 Novi Beograd, Phone +38164 2577 575, E-mail: andrijasn3@gmail.com, ORCID ID (https://orcid.org/0000-0001-8317-9285)

3 Slobodan Petrović, PhD, Assistant Professor, Faculty of Social Sciences, Univerity Business Academy Novi Sad, Bulevar umetnosti 2a, 11070 Novi Beograd, Phone +38164 2577 575, E-mail: 62 350 650, E-mail: slobpetrovic@yahoo.de, ORCID ID ((https://orcid.org/0000-0002-9343-5999)

ensures food security and contributes to rural development and ecological balance. According to the geographical position, the Republic of Serbia has areas in which there are opportunities for both extensive and intensive type of agricultural development. With land meliorization, it is believed that only AP Vojvodina is such a fertile plain that it could feed half of Europe (Đurić, Prodanović, 2017).

Agriculture is the oldest economic activity in Serbia, today with a relatively modest position in the country's economy. During the period of the monarchy, from 1882 to 1944, Serbia was one of the less developed agricultural countries, and during the socialist period, from 1945 to 1990, with a lot of effort it became a medium developed industrial state with relatively strong agricultural production and food industry. In the years of economic transition, at the beginning of the 21st century, however, Serbian agriculture entered a period of stagnation and crisis. Its relatively unfavorable position in the economy was the result of systemic neglect by economic policy makers. Instead of investing in this strategically important economic branch, with distinct comparative advantages, a retrograde process of disinnvestment took place in Serbia (Pejanović, Cvijanović, Njegovan, Tica, 2009).

Basic characteristics of Serbian agriculture

The Republic of Serbia has 5.06 million hectares of agricultural land, of which 71% is used intensively, in the form of arable land, orchards and vineyards, while 29% of agricultural land is natural grassland - meadows and pastures. The dominant part of agricultural land, 3.3 million hectares or 65%, is in the form of arable land, of which about 7% is not used annually, i.e. remains in the form of fallow land or uncultivated land (Statistical Office of Serbia, 2020). In addition to areas that are left for fallow, a significant part of the area under meadows and pastures is not used due to inaccessibility, weeds or due to economic unprofitability. It is estimated that between 200 and 350 thousand hectares of arable land and meadows are not cultivated every year, while the area of unused agricultural land, including pastures, is about 13% of the total arable agricultural land (Ševarlić, 2015).

In addition to insufficient use of arable agricultural land, the key problems of agriculture in the Republic of Serbia are: a large number of elderly rural households and unprofitable production on a significant number of agricultural holdings. The main reasons for this phenomenon are the long-term demographic and economic problems faced by privatized agricultural farms (Gnjatović, Leković, 2019). Namely, the uncultivated areas are mostly where the elderly rural households remained as owners. According to the 2012 Census of Agriculture of the Republic of Serbia, the average age of the rural population in Serbia was 59 years (Statistical Office of Serbia, 2014). Also, the economic unprofitability of using certain lands that are of poorer quality or do not have the appropriate infrastructure is visible.

The problems faced by the agriculture of Serbia have caused a lag in its development compared to the development of agriculture in the European Union. At the global level,

with the increase in the level of economic development, the share of agriculture in the formation of GDP is decreasing. This is the case with the countries of the European Union, where in the period from 2001 to 2020, GDP per capita increased from 17,185 US dollars to 34,173 US dollars (The World Bank Data, 2022a), and the contribution of agriculture to GDP decreased from 2.6% to 1.3% (The World Bank Data, 2022b). In the same period, in the Republic of Serbia, GDP per capita increased from 1,727 US dollars to 7,731 US dollars (The World Bank Data, 2022c), and the contribution of agriculture to GDP decreased from 14.6% to 6.3% (The World Bank Data, 2022d). Despite the decrease in the share of agriculture in the GDP of the Republic of Serbia, it is still significantly higher than the corresponding average indicator for the countries of the European Union (Table 1).

Table 1. The share of agriculture in GDP of the Republic of Serbia and the EU, 2001-2020, in %

Year	The Republic of Serbia	European Union
2001	17.8	2.2
2002	12.9	2.1
2003	11.4	2.0
2004	11.7	2.0
2005	10.0	1.8
2006	9.5	1.7
2007	8.3	1.7
2008	8.7	1.7
2009	8.0	1.5
2010	8.5	1.6
2011	9.0	1.7
2012	7.5	1.7
2013	7.9	1.7
2014	7.7	1.7
2015	6.7	1.6
2016	6.8	1.6
2017	6.0	1.7
2018	6.3	1.6
2019	6.0	1.6
2020	6.3	1.7

Source: The World Bank Data (2021c, 2021d)

This fact indirectly speaks of a lower level of economic development of the Republic of Serbia compared to the average level of development of European Union countries, because the share of agriculture in the GDP structure of the Republic of Serbia is four times higher than the corresponding indicator for European Union countries. It should be noted that the high share of agriculture in the GDP of the Republic of Serbia

compared to the share of this sector in the GDP of the European Union countries can be partly attributed to the relatively slower process of technological progress of industry (Savić et al., 2016).

With industrial development, there is a long-term tendency to reduce the share of agriculture in the total population, where the agricultural population refers to persons whose livelihood depends on agricultural production. This tendency is a feature of the process of deagrarization, i.e. abandonment of agriculture, in which the population engaged in agricultural activities is retrained and employed in other economic activities, in industry and the service sector, mostly in urban centers. Such demographic trends can be attributed not only to faster growth and development of industry and service activities than agricultural growth, but also to intensification of agricultural production and an increase in productivity of this strategically important economic activity (Đurić, Njegovan, 2016). The phenomenon of deagrarization is related to the phenomenon of depopulation of rural areas. While in 2001 in the European Union the rural population participated with 29% in the total population, its share in the total population by 2020 was reduced to 25.5% (The World Bank Data, 2022e). With industrialization and urbanization, in the Republic of Serbia there was a process of deagrarization, as well as the process of depopulation of rural areas, i.e. the concentration of population in urban centers. These processes are indicated by census data. According to the 2002 census, the share of agricultural in the total population was 10.9%, and according to the 2011 census, it was reduced to 8.8%. At the same time, there was a depopulation of rural areas and a concentration of population in urban centers as the share of rural in the total population decreased from 47% in 2001 to 44% in 2020 (The World Bank Data, 2022f). The presented comparative data clearly indicate that the process of depopulation of rural areas in the Republic of Serbia would continue in the coming years.

Tasks of agrarian policy

Since agrarian policy is one of the public policies, i.e. the policy created by the state, in that way it is related to and influenced by numerous factors that determine and regulate it more closely (Blanuša, Petrović, Stevanović, 2021). In the field of agricultural policy, the state can actively participate and influence the development of agriculture by introducing subsidies for individuals and legal entities, especially when it is in the public interest to protect citizens and the economy, to support investment and employment, build infrastructure, provide education of agricultural personnel and, above all, provide safety in the production of healthy food (Lencucha et al., 2020). The state can also provide certain services to the economy, through public companies, institutions and agencies owned by it, and when they are provided by the private sector, then the state can encourage them through public-private partnerships (Ponnusamy, 2013).

The main task of economic policy makers is to find spots for intervention, i.e. points where it is possible to achieve important and desired changes in the field of agriculture, so that it can be continuously improved and modernized (Bonnen, 1973). These important points of change most often appear in the form of innovated laws

and rules, changes in organizations that affect the creation of agricultural policy in the form of ministries, administrative institutions, agencies, as well as encouraging, strengthening and redirecting already initiated systemic reforms such as privatization, entrepreneurship and decentralization. By analyzing the situation in the economy, and thus in the agriculture of a country, one can find out the problems and reasons for insufficient regulation of a certain area and reduced efficiency of the same. The analysis can determine the success of the applied instruments and measures of agricultural policy, in order to identify and solve problems. First of all, it is necessary to discover the causes of insufficient efficiency of a certain agrarian policy and to define the activities that must be done in order for that policy to be successful, i.e. more efficient (OECD, 2020). Within every activity related to agrarian policy, it is necessary to act in such a way that the effects resulting from its implementation are as positive as possible. And we can say that it is desirable for this policy to be as economical as possible (Shikur, 2020).

Agrarian policy is a set of measures of economic policy, which includes the entire activity of its bearers directed towards agriculture. Agrarian policy is most often defined as a consciously directed action of the government realized in the food sector so that limited resources are optimally used in order to achieve production results that are in line with the social belief "what should be". In that sense, the agrarian policy is aimed at creating an ideal food system that should ensure the realization of a mix of diverse goals seen through the need to provide: adequate food for all; cheap food; available food throughout the year; health safe food; and appropriate lifestyles for farmers (Drummond, Goodwin, 2010).

From the above, we can conclude that the process of creating agrarian policy and its transmission to economic flows is very complex and slow and requires the activity of a large number of actors and institutions. As soon as a problem that has arisen in the agro-system is defined, the development of possible actions that can solve that problem is automatically started, which means that a new, more efficient agrarian policy is approached. At that moment, the authorities of the state appear, which must officially adopt such a policy in order for it to work. This is followed by the implementation of such a policy in order to implement those activities that are considered to bring progress to agriculture and the food industry of the national economy. The last step in implementing an agricultural policy is its evaluation to determine its effects and its justification in the decision-making system that affects the development of the economy (Staniszewski, Borychowski 2020). The analysis of such a policy sometimes, often, gives unexpected results because it may not work as intended.

The Republic of Serbia has a relatively long tradition of policy in the field of rural and regional development, dating back to the SFRY period. In socialist Yugoslavia, there were pronounced regional disparities in the development of the federal units, as well as heterogeneity in natural resources and in the production, economic and organizational parameters of agricultural production (Simovović, Tomić, 2001). In the early 2000s, agrarian policy was mostly aimed at resolving problems related to very difficult situation that arose after the political crisis and financial problems of the

1990s, with large variations and unfavourable trends in the share of the agrarian budget in the central government budget. (Kuzman et al, 2017).

During the first decade of the 21st century, the agrarian policy of the Republic of Serbia has made a serious shift in strategic directions and mechanisms of its implementation, First, the government support has been focused only on registered agricultural farms; second, the diversification of government support measures has been introduced aimed at increasing the competitiveness of family commercial farms; third, the mechanism of government support has been transformed, from the policy of price and income incentives, to the policy of investment incentives (Pejanović, Radović, 2011). In that period, the Agricultural Development Strategy (2005) was adopted, and since 2007 the system of direct payments per hectare of sown area, i.e. livestock, has been more presented, and support for investments, modernization and rural development has increased but to a modest extent.

Both in the first and in the second decade of the 21st century, the state insisted on the adoption of numerous documents for the regulation of the agricultural sector, i.e. for the revival of agricultural production. In this regard, the necessary strategies and economic policy plans have been adopted, aimed to contribute to the modernization and progress of agrarian activity. Among them, most important have been Agricultural Development Strategy (2005) and Agriculture and Rural Development Strategy of the Republic of Serbia for the period 2014-2024 (2014). These strategic documents showed the readiness of the state to take important steps in the direction of agricultural development, modernization of rural areas, poverty reduction, as well as the reductiom of the unemployment rate in rural areas. In this paper, we refer to the measures of agrarian policy, outlined in these documents that are directly related to the issue of improving agricultural production.

Agrarian policy measures in agricultural development strategies

The 2005 Agricultural Development Strategy defined the long-term development goals of the primary sector of the economy. The emphasis was on building a sustainable and efficient agricultural sector that could compete in the world market, contributing to the growth of national income. In the forefront was the provision of food that meets the needs of consumers in terms of quality and safety, as well as providing support for living standard for people who depend on agriculture and are not able to follow the pace of economic reforms. Also, the issue of sustainable rural development as well as the preservation of the environment from the impact of possible adverse effects of agricultural production has taken an important place in the strategy. All these strategic commitments were placed in the context of the preparations of Serbia for the integration in the European Union as well as the preparation of domestic support and trade policies in agriculture for the Word Trade Organization rules (Agricultural Development Strategy, 2005).

In the field of market economic reforms, which were undertaken in the Republic of Serbia in the first decade of the 21st century, the determination of economic policy makers was the harmonization of the economic system with the economic system of the European Union. Strategic commitments in the field of agricultural policy should be viewed in this light (Cardwell, 2004). When it comes to the tasks of agricultural policy whose implementation should have realized the set strategic goals, the mentioned Strategy emphasized the progressive reform of the customs protection system and domestic subsidies, so that they would have less influence on producers' decisions on what to produce, leaving them free to follow the market and to choose the ways to adapt to that market (Stanković, 2012). Three phases of reform were envisaged.

In the first phase of the reforms, the mentioned Strategy envisaged that government subsidies would be gradually reduced and that funds would be redirected to investments that would make agriculture in Serbia more profitable. Some of these forms of support, such as loans, should have been completely neutral, without giving instructions on what the producer should produce, while grants and input support would have been more focused on certain products. The mentioned Strategy also envisaged that all support possibilities be published and available to everyone, so that producers could have complete information when deciding what to produce. In the second phase of the reforms, a reduction in the subsidy for inputs was envisaged, as this would be required of the Republic of Serbia upon its accession to the World Trade Organization. At the same time, it was planned to increase the funds of the grant program and to focus on rural development, in the same way as the trend in the European Union, which should have resulted in further weakening of the link between state support and producers' decisions to produce. In the third phase, which would end with the access of the Republic of Serbia to the European Union, conditions would be created for the adoption of the EU Commom Agricultural Policy support system, which would then be applied. Support systems would then be concentrated on the area of the payment system and linked to different environmental criteria, but in no way related to producers' decisions about what to produce (Blanuša, Petrović, Stevanović, 2021).

The message sent by the above mentioned Strategy was primarily focused on the necessity of technological development in the field of mechanization in order to achieve continuous improvements in agricultural production and increase efficiency in various spheres of agricultural activity. Namely, the progress in the mechanization sector enables man to cultivate much larger areas and to raise larger herds of cattle. Also, mechanization increases productivity per hectare (Savić et al., 2016). The problem that accompanies the use of mechanization in agricultural production is the trend of falling prices of agricultural products, which means that producers are forced to increase their farms to provide the same level of earnings (Pejanović, Njegovan, 2011).

The goal of building a sustainable and efficient agricultural sector, set by the Agricultural Development Strategy from 2005, has not been achieved in the coming period. In the second half of the first decade of the 21st century, there was a relatively spontaneous privatization of socially owned companies in the Republic of Serbia, with modest

foreign investments. Among the privatized companies, there were also companies in the food industry and most agricultural combines. The result of these spontaneous reforms was the creation of an uneconomical structure of fragmented agricultural holdings and the aggravation of problems in agriculture that marked its development.

Due to the fact that the the goal of building a sustainable and efficient agricultural sector had yet to be achieved, nine years after the Strategy from 2005, a new Strategy for Agricultural Development was adopted (Strategy for Agriculture and Rural Development of the Republic of Serbia for the period 2014-2024, 2014). This Strategy has been fully oriented to the institutional changes which would enable the Republic of Serbia to adjust to the standards of the Common Agricultural Policy of the European Union. It emphasized the importance of the responsibility of the state in defining a framework of political and institutional changes that would contribute to more efficient development of the agricultural sector and welfare of rural residents. In order to adequately fulfill this goal, it has been stated that the obligation of the state is to respond to current challenges with a stable, long-term and efficient policy. In this sense, the wording of this Strategy has been motivated by the need to respond to internal and external challenges with a new concept of agricultural policy. The need to reduce the technological development gap with competing countries and enable the agricultural sector to cope with the effects of climate change more efficiently was emphasized. Also, the necessity of increasing the efficiency of the food chains and the competitiveness of the agri-food sector was emphasized. As in the previous Strategy, significant attention has been paid to providing a stable income and business environment for farmers and other entrepreneurs in rural areas. Also, the need to achieve economic, environmental and social goals of sustainable development was underlined, in which multifunctional agriculture and rural development would have a special place. Further, the readiness to respond to the requests arising from the process of joining the World Trade Organization and the European Union has been confirmed once again.

Implementation of agrarian policy measures

One of the most important documents related to the implementation of agrarian policy measures based on the Strategy for Agriculture and Rural Development of the Republic of Serbia for the period 2014-2024 (2014) has been the National Program for Agriculture for the period 2018-2020 (2017). It was an operational plan for the implementation of agrarian policy whose ultimate goal has been the effective integration and implementation of the EU agricultural policy in Serbian policy making. The Program contained measures classified as direct payment measures, market regulation measures, as well as special incentives and credit support in agriculture. Its curriculum also defined starting points and general and specific objectives of agricultural policy, types of measures and dynamics of their adjustment to the final form of implementation with the envisaged financial amounts and basic rules for implementation, as well as indicators for measuring achievement of base and target values. The Ministry of Agriculture, Forestry and Water Management has been responsible for the implementation of

this National Program, with the Sector for Agricultural Policy in charge of creating agricultural policy measures, while the Directorate for Agrarian Payments has been responsible for implementing measures. Until the end of the program period, the Ministry of Agriculture, Forestry and Water Management tried to fulfill all planned activities in administrative, financial and essential terms, so that the Program would have been implemented in accordance with the EU criteria and the Law on Incentives in Agriculture and Rural Development (2016),

It is known that the success of agrarian policy depends heavily on the availability of government budget means for the realizaton of its goals. The main source of financing of agrarian policy in the Republic of Serbia is the central government budget (Kuzman et al., 2017). An additional source of financing are budget funds at the level of local administrative units, as well as budget funds at the level of the Autonomous Province of Voivodina. Budget funds of local adminisrative units and Autonomous Province of Voivodina are realized through programs to support the implementation of agricultural and rural development policy and could be used to finance all measures provided by the Law on Incentives in Agriculture and Rural Development (2016) except for certain measures of direct payments (Blanuša, Petrović, Stevanović, 2021).

Table 2. The share of agrarian budget in total government budget of t he Republic of Serbia 2005-2020, in %

2005	4.1	2013	4.3
2006	4.7	2014	4.1
2007	3.6	2015	4.2
2008	4.7	2016	3.6
2009	3.7	2017	3.8
2010	3.8	2018	3.5
2011	4.1	2019	5.0
2012	4.0	2020	5.1

Source: Ministry of Agriculture of the Republic of Serbia

The budget funds from central government, local administrative units and autonomous province of Voivodina aimed for agricultural and rural development form the agrarian budget of the Repulbic of Serbia. According to the data for the period from 2008 to 2017, presented in the National Program for Agriculture for the period 2018-2020 (2017), the agrarian budget has been relatively modest, amounting to less than 5% of overall government budget. If we look at this indicator for the previous years of the analyzed period, from 2004 to 2017, we can see that the share of agrarian budget in the total government budget has been maintained on the same low level (Table 2). Namely, in 2004 it was prescribed that the state must allocate at least 5% of overall budget funds for agriculture but that goal has never been reached except for 2004. The same is true for the period following the adoption of the National Program for Agriculture for the period 2018-2020 (2017) According to the corresponding data for the period from 2018 to 2020, published in the Draft National Program for Agriculture for the period 2022-2024 (2022), it follows that the share of agrarian budget in the total government budget

has finally reached the legal 5% minimum in 2019 and 2020. Comparisons with the corresponding allocations in the European Union speak of relatively modest allocations from the budget of the Republic of Serbia for agriculture. The European Union uses one third of the total revenues of its budget to finance the Common Agricultural Policy (Grbić et al, 2013).

In the process of the preparation for membership in the European Union, the Republic of Serbia has the obligation to adjust its policy and legislation to a very complex European model of agriculture. With the implementation of activities envisaged by the National Program for Agriculture 2018-2020, the institutional framework of agriculture should have been at a level that would enable the implementation of all relevant EU policies, as well as the functioning of the system in such a way that domestic producers preserve maximum benefits. However, the tasks set by the said Program have only been partially achieved. It is even possible to state that the process of adjusting the agricultural policy to the European model of agriculture is still in the preparatory phase. Namely, the preparations for this process so far have been focused on the adoption of legal solutions and adjustment to the acquis communautaire. A number of laws and regulations have been adopted, but their effective implementation is still at an early stage in most areas. As a positive development, the first steps in establishing new and improving existing bodies and organizations can be considered. Further harmonization of domestic legislation with the legislation of the European Union should take place with continued training and development of the administration, entrepreneurs, farmers and all other actors related to the implementation of this very demanding legislation. When assessing the degree of implementation of the National Program for Agriculture 2018-2020, it is necessary to look at the state's support for agricultural development. In the published Draft National Program for Agriculture for the Period 2022-2024 (2022), there is a statement that the agrarian budget should has been still insufficient for more efficient development of agrarian sector of the economy. Incentives for the training of staff in agricultural farms, as well as for strengthening ties between the state administration and farmers who need expert and administrative assistance in order to apply for and use state subsidies and foreign aid, are particularly stressed.

Conclusion

The economic policy makers in the Republic of Serbia are trying to contribute to the revitalization of this extremely important branch of the economy through various measures of agrarian policy, but no measure has so far yielded sufficient results. What would revitalize agricultural production, and thus the economy and society of the Republic of Serbia, because agriculture is the basis of any developed national society with such or similar geographical features, is market-oriented economic policy, investment in mechanization, agricultural infrastructure development, with state incentives to raise the level of motivation and training of agricultural holders.

The Republic of Serbia does not have a sufficiently developed role of agriculture in economic development, which is indicated by the relatively low agrarian budget and

only partial implementation of the established agrarian policy. Inadequate treatment of agriculture results in the fact that the process of deagrarization and depopulation of rural areas has not been stopped yet. The construction of the necessary infrastructure, access of the rural population to agricultural schools and other relevant educational institutions, as well as the development of health care for agricultural producers will be basic parameters for assessing the effects of measures to be taken by the Republic of Serbia in the coming years.

Conflict of interests

The authors declare no conflict of interest.

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ORGANIC PRODUCTION OF LAVENDER IN SERBIA - ECONOMIC AND FINANCIAL ANALYSIS

Ljiljana Kontic[1], Olgica Zečević Stanojević [2], Mile Vasić [3]

**Corresponding author E-mail: ljiljana.kontic@yahoo.com*

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ABSTRACT

The main aim of this study is to access possibilities of organic production of lavender in Serbia. As a result that 1999 and 2020 have been dubbed the "Year of Lavender" in the US, researchers and practitioners focused various aspects lavender production and cultivation. Lavender is an aromatic-medicinal plant, cultivated in Mediterranean region. The plants have used twofold: as an essential oil as well as a flower. In this study, the authors use a comparative analysis and feasibility study as research methods. The results of comparative analysis revealed that the main countries in organic production of lavender were Bulgaria, France, China, Ukraine, Spain and Morocco. Also, the feasibility study in Serbia showed positive effect on organic lavender production in Serbia. This can be the case study for organic production of lavender to other farmers in Serbia. The limitations and future research agenda will be presented, too.

Introduction

The main proposition of organic agriculture is healthy ground-healthy herbals and animals-healthy people. According to World Health Organization (WHO), herbs are kind of plants which one or more parts contain biological active elements which can be used in therapy or pharmacy. There are about 700 species of medicinal, aromatic and spice plants in Serbia, and close to 300 are in circulation (Jevdjovic, 2012). However, irrational, uncontrolled and unprofessional collection cannot be unlimited. It is necessary to respect the principles of sustainable use of natural resources, and thus greater education of the population about organic collection and organic plantation cultivation.

1 Ljiljana Kontic, Associate Professor, University MB, Faculty of Business and Law, address Novopazarska 48, Belgrade, Phone: 0641705582, E-mail: ljiljana.kontic@yahoo.com, ORCID ID; (https://orcid.org/0000-0002-5117-0419)

2 Olgica Zečević Stanojević, Full Professor, European University, Faculty of European Business and Marketing, Vojvode Dobrnjca 15, Belgrade 11000, Serbia, Phone: +381 63 233 599; E-mail: olgicazs@gmail.com,

3 Mile Vasić, European Marketing and Management Association, Knežopoljska 5, Banja Luka 78000, Banja Luka, Bosnia and Herzegovina, E-mail: vasic.mile@gmail.com, ORCID ID https://orcid.org/0000-0002-5637-9289

The main idea of the authors is to analysis organic production of lavender due to the fact that organic production of medical and aromatic herbs participates in the percents less than 1% in total organic food production in Serbia.

There are a few studies that analyzing conventional or organic production of lavender from the perspective of business analysis and project management (Adam, 2006; Lesage-Meesen et al., 2015; Giray, 2018). Therefore, aforementioned argument, along with practical usefulness, motivates the authors of paper to conduct the research entitled *The feasibility studies of organic production in the Republic of Serbia*. In this study, the authors will present preliminary results about organic production of lavender in Serbia.

This paper is structured as follows. The first part is devoted to the general information of production of lavender, review of past research and compilation of harvest yields. In second part, the research materials and methods are presented. The third part outlines the results divided into five main sections: Impact of COVID-19 on the organic market, Review of the largest producers of lavender flowers, An Analysis of the World lavender oil market, Organic production of medical and aromatic plants in Serbia, and Feasibility Study of organic lavender production at farm X in Serbia. The final part presents the discussion.

General information about lavender production

There are various botanical names of lavender, i.e. *Lavandula angustifolia, Lavandula x intermedia*. But common names for lavender are garden lavender or common lavender.

The first decision in lavender production is to choose between the followed commercial uses (McCoy, 1999): fresh flowers, dried flowers or cosmetic manufacturing i.e. soaps, or oil. The production of lavender includes two main lavender varieies, such as (McCoy, 1999):

1. **Lavandin varieties** (*lat. Lavendula x intermeidia*) are high productive both in form of crops and essential oil, as well. Lavandins flowers have slightly gray color. Commercial names of lavandin oil are "*Grosso, Abrialii, Suer, Standard, or Maime Epis"*. Tender "*Lavenders L. latifolia"*, or "*Spike Lavender"*, can be hybrid but also native species of *lavandin* originated from the Mediterranean region. "*French lavender or Fringed lavender"* (*lat. Lavendula dentata*) raises in Spain and primary uses in dried form. "*L. stoechas, Spanish lavender"* has dark purple flowers, and also used for same purpose. It is appropriate for acid soils. "*Lavandula x allardii, or giant lavender"* is a hybrid form when cross aforementioned two species of lavandin.
2. **English lavender** (*lat. Lavendula angustifolia*) varieties have blue flowers, and best suited in dried form. The best known commercial names of English Lavender including the "*Nana Alba, Rosea, Jean Davis, Lodden Pink, Twickle Purple, Royal Purple, Mitcham Cray, Munstead, and Summerland Supreme"*. The ability to flower twice has "*Irene Doyle"* (Tucker, 1984) as well as high concentration of oil therefore it suitable for production of essential oil.

All varieties are flowered in the period from mid to late June to early July. The concentration of water in crops are 70-80% water and became dried in 7 to 14 days. Harvest time for some varieties is from the second through the fifth year, and for others can be up to 30 years. For fresh flower use, the harvest is manually. For production of essential oil, lavender is harvest by specially designed machinery.

Review of past research

The majority of studies about lavender are in the field of Phytochemistry (i.e.Vokou, 1993; Sharma et al., 1992), Chemical technology, Food technology, and Medicine (i.e. Buchbauer et al., 1992), and Economics of Agriculture (Foster, 1993; Marz et al., 2012; Marz et al., 2013; McCoy, 1999 Willer et al., 2021; Golijan, 2016; Kalentic et al., 2014; Simic, 2017; Pantiž et al., 2021; Fedajev et al., 2021). There are a few studies that analyzing conventional or organic production of lavender from the perspective of business analysis and project management (Adam, 2006; Lesage-Meesen et al., 2015; Giray, 2018). Therefore, aforementioned argument, along with practical usefulness, motivates the authors of paper to conduct the research entitled *The feasibility studies of organic production in the Republic of Serbia*. In this study, the authors will present preliminary results about organic production of lavender in Serbia.

Since 1999 was announced as "Year of Lavender" in the United States, the interest for information and literature about production of lavender had been increased. The analysis of relevant literature in the U.S. showed the following (McCoy, 1999):

- All interest parts in lavender production need to understand that Lavendula species has complex variety. The choice will be depend on production goals, such as fresh or dried flower or oil.
- The essential oil production embodies knowledge about the phytochemistry of lavender varieties.
- During the time, numerous aspects of lavender use have been found (i.e. aromatic, cosmetic, culinary, decorative, medical),
- Traditionally, lavender has been used as a perfume and for antimicrobial purpose.
- It is important to note that lavender has been used since the first century A.D. but it is still remained a common herb in almost every household.

The results of the studies during the 90-ies of XX pointed to new using of lavender essential oils such as:

- To storage food (Vokou, 1993);
- To protect wardrobe against inspects (Sharma et al., 1992);
- Medical use as sedative (Buchbauer et al., 1992).

Comparative of the harvest yields of essential oil and flowers from lavender crops

The majority of studies have been conducted over 30 years ago (Foster, 1984; McGimpsey, 1994; El-Sherbany et al. 1997). The study from the Netherlands showed that essential oils of lavender can be used as natural pesticide, especially to storage food (Vokou, 1993). The same results of this characteristics have been proven in India (Sharma et al., 1992). Other important results have been same concentration of essential oil of natural lavender as well as hybrid crops.

The comparative analysis between various size of stem showed that the highest percentage of rooting was obtained from 8-10 cm long (Boyadzhieva et al., 1977). The experiment conducted in Bulgaria embodied mechanized cultivation and harvest (Tsachev, 1976). The researchers have compared three French varieties of lavender such as "Superb, "Abrial", and "Normal" to determinate the concentration of essential oil. The results showed better yields of first two aforementioned varieties (Chingova et al. 1973).

Materials and methods

The source of meta data about organic agriculture at the world has been *The World of Organic Agriculture Statistics and Emerging Trends 2021* (Willer et al., 2021). Data about organic agriculture in Serbia have been collected from the followed sources:

- *Organic agriculture in Serbia 2012* (Marz et al., 2012),
- *Organic agriculture in Serbia 2013* (Marz et al., 2013),
- *Organic agriculture in Serbia at a Glance 2014* (Kalentic et al., 2014), and
- *Organic agriculture in Serbia at a Glance 2017* (Simic, 2017).

The authors collected and analyzed various statistical data, such as:

- Data about organic medical and aromatic plants in Serbia in 2015, collected by Ministry of Agriculture of Republic of Serbia (Golijan, 2016),
- Data about new agriculture enterprises in Serbia (Fedajev et al., 2021), and
- Data about production of fine lavender essential oil worldwide (Giray, 2018).

In this study, we used a mix method approach. Content analysis has been used for qualitative data. Analysis of quantitative data has been conducted with comparative analysis (i.e. lavender oil production (Lesage-Meesen et al., 2015), as well as cost-benefit analysis in the feasibility study of organic lavender production at Farm X in Serbia. The main goal of cost-benefit analysis is to determine feasibility of the project by gathering information about total costs and benefits of the project. Cost-benefit analysis is " a systematic method for quantifying and then comparing the total costs to the total expected revenues of the project" (Stobierski, 2019; Lojaničić et al., 2021). The main advantages of cost-benefit analysis can be summarized through data-driven approach, simplifying decision making process, and uncovers hidden costs and benefits, on the

one side. On the another side, disadvantages are difficult to predict all variables, better suited to small and medium projects, and removes the human factor.

Next section is devoted to research results.

Results

The results of this study present into the following parts:

3.1. Impact of COVID - 19 on the organic market

3.2. Review of the largest producers of lavender flowers

3.3. An Analysis of World Lavender Oil Markets

3.4. Organic production of medical and aromatic plants in Serbia

3.5. Feasibility study of organic lavender production at Farm X in Serbia

Impact of COVID-19 on the organic market

The results of one study have been revealed that during the COVID - 19 pandemic, food sales growth rapidly. Health, climate changes, and environmental issues become more important during the pandemic (Willer et al., 2021).

The key question is: *Will organic production continued to growth after COVID-19 pandemic?* The analysis of aforementioned meta data showed that interest for organic products would continue to growth (Willer et al., 2021). It is important to notice that in some groups of existing consumers the salaries are less than before 2019. Therefore, they will not be able to buy same nor more organic products than before 2019.

The results of scenario analysis revailed that organic production would raise by the same rate as organic market. The small and medium enterprises are dominant at organic market. In the case of Serbia, the results of the analysis of number and share of new enterprises are presented in Table 1. The same trend will be continued along entering new ones.

Table 1. New agriculture enterprises in Serbia in the period 2015-2019.

Year	No of enterprises	Index (previous/ current year)	Share in total new enterprises
2015	235	114.00	0,51
2016	262	111.50	0,55
2017	294	112.20	0,57
2018	333	115.00	0,58
2019	1,138	341.70	0,54

Source: Fedajev et al. (2021), p.554

In the industry of organic production of food, the financial support will be necessary. This financial injection can be provided by various EU funds or National Investment Funds. In Slovenia, the project entitled *Biodiversity's restoration, preservation & enhancement - Organic production of lavender* started in 2017 (*See at website* https://najdistoritev.si/iskalnik/izdelki-iz-sivke/)

Review of the largest producers of lavender flowers

Table 2. presents the largest producers of lavender flowers in the world. The base year was 2017. and the prices indexed in U.S. dollar ($).

Table 2. The largest producers of lavender flowers in the world in 2017

Product Name	Size	Country	Price
Lavender Flowers Extra	1lb	Croatia/Albania	$22.75
Lavender Flowers Extra	4 oz	Croatia/Albania	$8.92
Lavender Flowers Super	1lb	France	$33.92
Lavender Flowers Super	4 oz	France	$11.75
Organic Lavender Flowers Extra	1 lb	Croatia/Albania	$27.67
Organic Lavender Flowers Extra	4 oz	France/Albania	$10.17
Organic Lavender Flowers Super	1 lb	France	$40.42
Organic Lavender Flowers Super	4 oz	France	$13.33

Source: Starwest Botanicals (2021)

The data from the latest review in European Union showed that in 2018, 21.1% of French lavender were grown organically and Bulgaria has produced more than 24,500 tons of organic lavender (Willer et al., 2019).

An Analysis of World lavender essential oil markets

The main producers of lavender essential oil production came from Bulgaria, France, China, Ukraine, Spain and Morocco (Lesage-Meessen et al. 2015). In 2016, 380 tonnes of lavender essential oil have been produced, and the portion is 280 tonnes came from Bulgaria, and the rest 100 tonnes from France (Giray, 2018). Worldwide the producers used more than 30 species of lavender to produce Lavender Essential Oil. Each species of Lavender is renown for different purposes. To produce the highest quality of Organic Lavender Oil – Bulgarian Lavender Essential Oil the best variety is "Lavandula Vera", also known as "Bulgarian Lavender". The main producers of organic lavender oil in Bulgaria are:

1. Organic lavender Bulgaria (http://www.agrobiofarm.com/lavender-oil/)
2. Lavande Biologique Bulgarie.

The most famous producers of French lavender are:

- Dried lavender Organic (https://daisyshop.co.uk/Dried-lavender-Organic),
- Organic Lavender, French (https://www.absolute-aromas.com/cms.jsp?menu_id=25048&prodref=OR023%2F10ML).

According to Davis (2020), as a results of focus on lavender in North Carolina many new, small lavender farms have been established. Well-known varieties of lavender that can be cultivated are: Provence, Grosso, Phenomenal, Hidcote, Munstead, and Superblue. Mainly U.S. A. lavender producers are focused on essential oil and culinary uses. Beus (2021) stated the lack of market and infrastructure for lavender producers in the U.S. A.

Organic production of medical and aromatic plants in Serbia

Organic farming became more popular and profitable in Serbia (Simin et al., 2019). In the report entitled Organic production in Serbia, the authors have notice that there is no official methodology on which they can evidenced the information about total area of medical herbs (Marz et al., 2012). Same data can be found in the Study published in 2013 (Marz et al., 2013). In report for 2014, the authors concluded that there were no data about the areas exploited for medicinal herbs (Kalentic et al., 2014). Therefore, data about organic plant production are presented in Table 3.

Table 3. Organic production of medical and aromatic plants in Serbia

Year	Production (in tons)
2011	59.50
2012	28.40
2013	132.60
2014	60.90

Source: Simic (2017)

In 2015, the value of export of medicinal and aromatic plants has been in amount of 32.200 euros (Simic, 2017). According to data provided by Ministry of Agriculture of Republic of Serbia, and summarized by Golijan (2016), the organic medical and aromatic plants in Serbia, in 2015, was carried out on an area of 70.94 ha from which 68.27 ha have been in the organic status. The comparative 2015 to 2014, the production has been raised by 10.01 ha. The total turnover of medicinal plants in Serbia achieved equally by large - scale production and by collecting the wild herbs. The highest production of medicinal and aromatic plants was in region South and East Serbia, with 40.31 ha in 2015 (Golijan, 2016). Classification by plants varieties has been showed that the majority of organic plants cultivates lavender (23,45 ha).

There are no official data about organic production of lavender in Serbia. At this moment, in domain of lavender flowers production in Serbia there are two successful plant (i.e. Tamnjanica - Municipality of Bela Palanka) i Bukovac - Municipality of Novi Sad).

Therefore, the next section elaborates the main parts of the feasibility study conducted at Farm X in Serbia.

Feasibility study of organic lavender production at Farm X in Serbia

The main parts of feasibility study of organic lavender production in Serbia were:

1. Summary which embodied the following information: farm location, brief development of farm, the main reasons for investing own sources in lavender production (i.e. as a basis for product/service diversification), the list of other investors (i.e. EU fund, National or local investment fund raising).
2. The main results: In the last year, the Farm X increased its revenue by at least 80% (approximate value based on "Grily Naturae - kmetija Osterc – Investing in organic lavender production"). The exponential raise can be reached after third year.
3. General recommendation is to *increase people's awareness of high-quality, organic products* i.e. lavender. In order to do this, farm owners need to interconnect with local community as well as with other public authorities, and organizations that promoting organic food.
4. Cost/benefit analysis had been reviled that after third year yields from lavender dramatically increase therefore the profit start to increase as well. Investment can be expand to production of essential organic lavender oil, soap, creams.
5. *Key lessons for farm owners*: a) joint the Organic food cluster or engage other farm owners to start a organic lavender production, distribution, export or marketing.

Moreover, farm owners can form a Cluster of Organic lavender in Serbia or at local level; b) sell organic lavender at fairs and other events; c) connect with tourism organizations in order to increase revenues from lavender production; d) share agriculture machine with other farmers, and e) improve their knowledge about lavender productions, cultivation, seeds or varieties of lavender, distribution, marketing, export thorough partnership with universities and/or engaging consultants in aforementioned areas of expertise.

Table 4. presents the results of economic analysis. The lavender production can be productive. This goes in line with the results of one study conducted on 10 farms in Mediterranean region (GokDogan, 2016), ongoing European Union project in Slovenia ("Grily Naturae - kmetija Osterc – Investing in organic lavender production") as well as other studies conducted in developing countries (Gul et al., 2016; Singht et al., 2007; Kakraliya et al., 2022).

Table 4. Economic analysis of organic lavender production in Serbia

Cost and revenues	Value (in EUR per ha)
Variable cost	798.39
Fixed cost	615.20
Total cost	1413.59
Gross profit	1540.98
Net profit	925.79
Relative profit	1.66

Source: Authors' calculation

In order to determinate feasibility of organic lavender production following cost have been calculated: cost of lavender seeds, cost of cultivation, and workforce cost. Total cost were 1413.59 euros per hectar, and net profit was 925.79 euros per hectar. Compared to convential production of lavender total cost were 15% lower, and net profit was 17% higher when farmer produces organic lavender crops (See Table 5).

Table 5. Comparative analysis conventional vs organic lavender production

Indicators	Conventional	Organic
Total cost	1201.55	1413.59
Gross profit	1818.36	1540.98
Net profit	1092.43	925.79

Source: Authors' calculation

For lavender producers it is important to find out how consumers are getting information about lavender. The results confirmed that consumers have heard about lavender from friend and directly from producers (Campbell et al., 2019). This information is useful to producers and retailers to improve marketing efforts as well as to increase sales of lavender flowers.

The results showed that consumers' willingness to pay have been reached maximum level in case of lavender flowers and the minimum level for culinary lavender (Berning et al., 2020). This information is important to small producers of organic lavender because the production of lavender flowers are lower than culinary lavender or lavender oil.

In Romania small farmers started their lavender business firstly for economic reasons, but they have been aware of ecological-friendly aspects of organic lavender production (Vijulie et al., 2022). Same study showed the obstacle of lavender production i.e. lack of funding for machines for processing lavender crops, lack of workforce, and weak of market outlet. The main constraits for lavender farmers could be classified as price, production and market conditions (Gul et al., 2016). This can be useful for Serbian lavender producers.

Based on the results of feasibility study, the organic lavender production can be a rewarding and economically profitable business, but it is important to do marketing research of lavender products (Rittenhouse, 2018).

Discussions

Two years ago, a group of researchers were investigating if lavender's yield and concentration of essential oil can be improved by using bio-stimulants (Giannoulis et al., 2020). The results have been showed that application of bio-stimulants significantly improved yield of production of lavender, but further studies will investigate the effects on an essential oil quality.

Based on chronological reports on the organic agricultural sector in Serbia, we identified some emerging trends (Simic, 2017; Oljaca, 2012):

1. The huge potentials of development of organic farming in Serbia;
2. Existing actors are poor interconnected in value chain at organic market;
3. IPA Component V (IPARD) will be opportunity for organic farmers to get more than 60% of necessary investments.
4. Relative low wages and low taxes can be comparative advantage for Serbia to foreign investors.
5. The portion of agriculture in European Union economy is the largest, therefore, it absorbs most of the EU budget, this can be opportunity for Serbia.
6. Bilateral Agreement between Germany and Serbia can be realized thorough advisory about the IPA framework, university partnerships, intensive promotion of new technologies and marketing systems, along with support for organic agriculture associations and partnerships.

Recommendations for success in production of lavender can be summarized as follows (Beus, 2021):

- At least one year, potential farmers need to research about lavender production as well as to consult established farmers.
- In the case of essential oil production of lavender, basic knowledge about technology, marketing, investment funds along with partnership with university had been required.
- In the case of lack of market lavender infrastructure, the key to success will be value-added products of lavender.

From the feasibility study, it can be concluded that production of organic lavender is profitable business for small farmers in Serbia. This goes in line with other studies conducted in developing countries (Gul et al., 2016; Singht et al., 2007; Kakraliya et al., 2022).

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Conflict of interests

The authors declare no conflict of interest.

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THE FUTURE OF RURAL TOURISM IN THE REPUBLIC OF SERBIA

Suzana Borović[1], Katarina Stojanović[2], Drago Cvijanović[3]

**Corresponding author E-mail: suza.borovic@gmail.com*

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ABSTRACT

The Republic of Serbia has numerous predispositions for the development of rural tourism, considering that it represents a factor in the revitalization of the surrounding rural areas. Development and orientation towards "rural Serbia" could bring numerous advantages that relate to stopping migration flows from rural areas to urban areas and provide revitalizing the agricultural sector and other complementary activities. The aim of paper is to point out the importance of rural tourism, as one of the priority products of the Republic of Serbia, through the analysis of the current level of its development, and predicting future trends that promote the future of rural tourism. The methodology includes an overview of the theoretical framework of rural tourism collection of existing statistical data, obtained on the basis of previous research.

Introduction

The unique tourist product is the „aim" of the expectations of modern tourists, who are increasingly moving from mass and saturated tourist market towards non-standard tourist products, tending to new and unforgettable experiences.

Rural tourism is a topic that has been in the center of interest of numerous authors in recent years. This form of tourism represents an important component of integral sustainable development, both at the local and regional level, and at the level of the entire country, thus acting as an

1 Suzana Borović, M.Sc., Ph.D. student, Faculty of Hotel Management and Tourism in Vrnjačka Banja, University of Kragujevac, Vojvođanska 5a, 36 210 Vrnjačka Banja, Phone: +381621411967, E-mail: suza.borovic@gmail.com, ORCID ID (https://orcid.org/0000-0002-1654-4366)

2 Katarina Stojanović, Ph.D., Assistant Professor, Faculty of Hotel Management and Tourism in Vrnjačka Banja, University of Kragujevac, Vojvođanska 5a, 36 210 Vrnjačka Banja, Phone: +381631472416, E-mail: katarina.stojanovic@kg.ac.rs, ORCID ID (https://orcid.org/0000-0002-5261-3816)

3 Drago Cvijanović, Ph.D., Full Professor, Faculty of Hotel Management and Tourism in Vrnjačka Banja, University of Kragujevac, Vojvođanska 5a, 36 210 Vrnjačka Banja, Phone: +38163295111, E-mail: dvcmmv@gmail.com; drago.cvijanovic@kg.ac.rs, ORCID ID (https://orcid.org/0000-0002-4037-327X)

important factor in encouraging the development of various activities and strengthening the whole economy of the Republic of Serbia. In general, the exchange of experiences and good practices led to the general conclusion that rural tourism in the Republic of Serbia could play a key role in: increasing tourism activities that will generate more jobs in tourism or related industries and reduce unemployment, diversifying the rural economy; protecting and improving natural and cultural resources and revitalizing the countryside (Lakićević, 2020).

The demand for this form of tourism is constantly increasing, considering that tourists are more and more interested in interacting with nature, getting to know new landscapes, people, other cultures and customs. (Gašić et al., 2015; Pantović &Pantić, 2022). Tourist movements of these forms of tourism, are characterized by a smaller number of visitoris, and their movements usually have an individual character; as well as the fact that each tourist represents an individual, who has his own specific needs and the increasing participation of the local population (Todorović, Štetić, 2009). According to the Tourism Organization of Vojvodina (*The handbook for rural tourism*), trends in Europe and the world indicate that rural tourism has been growing rapidly in recent decades and the reason lies in the fact that people decide for shorter vacations and trips, travel more often by car, search for new experiences and return to nature and original values.

"Rural areas that were almost undeveloped and uninteresting for tourism are now in the spotlight. Although there are still no official data, according to some estimates, around 25% of tourists in the world opt for rural tourism each year. This trend will be continued in the future, and research conducted by the World Tourism Organization speaks in support of this." (Gašić et al., 2014; Ilić et al., 2021; Lakićević et al., 2022). Considering the fact that the Republic of Serbia has significant potential for the development of all forms of rural tourism, tourism as an important tertiary economic activity, the "service industry", should be one of the "locomotives" of the development of rural areas of the Republic of Serbia, along with agriculture, as a primary economic activity (Cvijanović, Ružić, 2017).

The rural area of Serbia is characterized by a large concentration of natural resources such as agricultural land, forests, water, with preserved ecosystems and biodiversity. Also, the wealth of cultural resources, as well as the preserved traditions of the people who live in this area, is one of the advantages of these areas. Natural and cultural resources, along with human resources, represent the most important elements of the rural base of Serbia (Cvijanović et al., 2016). Rural tourism is listed in the planning documents as one of the priority products of the Republic of Serbia. Nowadays, something "new" can only be offered if the focus is shifted from the traditional way of doing business to modern trends, and those trends that, together with the consequences of globalization, which conditions more and more changes on the market, initiating the permanent development of modern - informative solutions, in order to respond to the specific needs of consumers, at the same time representing the future of tourism.

The aim of paper is to point out the importance of rural tourism, as one of the priority products of the Republic of Serbia, through the analysis of the current level of its development and predicting future trends that promote the future of rural tourism.

Theoretical framework of rural tourism

Rural tourism is a concept defined in the Tourism Development Strategy of the Republic of Serbia for the period from 2016 to 2025 ("Official Gazette of the Republic of Serbia", no 85/2014) as "a series of activities and services that should be organized population of rural areas"

Rural tourism represents "ecological travel to relatively preserved areas, for fun and enjoyment in nature and is based on the principles of sustainable development and direct contact of tourists with nature and aims to improve living conditions, protect the environment and create conditions for performing other economic activities" (Radović et al., 2018), and is also used for terms related to tourist products and services that are directly related to the agricultural environment, agricultural products and staying in a rural environment (Donaldson, Momsen, 2011). Rural tourism, which has developed on family farms, has the primary aim of attracting a serious number of tourists, and at the same time generating additional income. (Jovanović, 2013), this product offers tourists a stay in a rural environment and nature presents the traditional hospitality of the local population, as well as their lifestyle and cultural values (Manojlović, 2021). The characteristic of rural tourism is that it has economic, social and political importance at the same time (Jing, 2006). The overall vision of the Master Plan for Rural Tourism of Serbia is the development of a master plan for socially, economically and ecologically sustainable rural tourism (The Master plan for sustainable development of rural tourism in Serbia). Rural tourism plays a key role in raising the living standards of rural communities and their economic development. European trends in the last couple of decades show that Europe is the world leader in the offer of rural tourism and will remain so for a long time (Živković, Mihajlović, 2010).

„Determining a rural area or a rural environment is difficult due to the fact that it is defined differently in different countries. The rural area is determined by three main factors: population density, land use, community identity." (Ružić, 2009). A rural area could be defined as „an environment with a small population concentration, whose main occupation is agriculture, characterized by a special way of life, work, customs and village identity. According to the traditional approach, rural areas in Serbia include 70% of the total territory with 43% of the total population, and according to the OECD definition, rural areas include 85% of the territory and 55.5% of the population with an average population of 63 inhabitants per km²" (Cvijanović et al., 2009).

Rural areas with preserved nature and the traditions of different rural areas have always attracted people to stay and rest. In recent times, people's interest in rural areas has increased, primarily due to environmental pollution, increasing alienation from the natural environment, uniformity and standardization offered by the modern way of life in urban areas. (Đenadić et al., 2016). Within the frameworkd of rural development, tourism has been identified as a key factor that will initiate the diversification of the rural economy (Ploeg, 2000). Rural tourism in Serbia and other European countries is defined as a significant factor of multifunctional rural development. Serbia is a

country of diverse and preserved nature, with many elements of attractiveness and representativeness, with a development priority in the direction of ecological and rural tourism, which has a great chance on the discerning international market (Petrović, 2014). Rural tourism is not a pure form of tourism, but is permeated by different types (eco, ethnic, sustainable, adventure, rural, agrotourism), the potentials for the development of different forms of rural tourism both in Europe and in Serbia have been defined (Janković, 2009). While modern trends in world tourism are looking for an undisturbed or at least minimally preserved natural environment, the chances of Serbia, as a country with diverse and preserved nature, are in the direction of developing ecological and rural tourism. The commitment to these types of tourism and the undoubted quality of the natural environment of the rural areas of all Balkan countries, with the numerous specificities of Serbia, are a good path towards the ultimate formation of a rural tourism development strategy (Milanović, 2008). "The millennium development aims of the Republic of Serbia are focused primarily on the eradication of extreme poverty and hunger, sustainability, environmental protection and the development of global partnerships for development" (Cvijanović, Ružić, 2017)

Materials and Methodology

In the research process, the methodology used refers to the review of the theoretical framework of rural tourism, and the basic conceptual definitions that characterize it, then data collection at the table in the form of an analysis of existing statistical data, obtained on the basis of previous research.

During the research in order to get the results, secondary sources of data were used (domestic and foreign literature, data specified in planning documents and strategies, which deal with the development of rural tourism in the Republic of Serbia, of which the Tourism Development Strategy of the Republic of Serbia for the period from 2016 to 2025 („Official Gazette of the Republic of Serbia", no. 85/2014) has a significant importance.

The data obtained for research purposes are relevant for the review of the current state of rural tourism development in the Republic of Serbia. The method of analysis was used to observe the essential characteristics of rural tourism, contemporary trends and an overview of future trends, which could significantly contribute to the development of rural areas of the Republic of Serbia. The method of description was used in the paper with the aim of analyzing the data found and their better interpretation.

The paper is divided into three theoretical backgrounds:

1. Analysis of the current state of rural tourism in the Republic of Serbia;
2. Predicting future trends of rural development in the Republic of Serbia;
3. The recommendations for the development of rural tourism in the Republic of Serbia.

Results and Discussions

Rural areas occupy 85% of the territory of the Republic of Serbia, while the great geographical diversity, wealth of natural and anthropogenic resources, multi-ethnic population, indicate that rural areas and more intensive development of tourism could play a key role in the future economic development of the Republic of Serbia the Tourism Development Strategy of the Republic of Serbia for the period from 2016 to 2025, („Official Gazette of the Republic of Serbia", no. 85/2014). "The Republic of Serbia (without Kosovo and Metohija) has a total of 631,552 agricultural farms, from wich, there are 628,552 family farms, that is, they occupy 99.52% of the total number of all agricultural farms" (Cvijanović et al., 2014). Rural areas are riched by ecosystems and biodiversity, natural rarities, various activities, cultural and historical heritage. *(Table 1)* shows rural accommodation in the Republic of Serbia.

Table 1. Rural accommodation in the Republic of Serbia

Type of accommodation	Number of objects	Percentage (%)
Suites	50	20.57
Log cabins and sculptures	26	10.69
Ethno villages	1	0.42
Guest houses	42	17.28
Hostels	1	0.42
Motels	1	0.42
Boarding houses	5	2.06
Lodgings for the night	5	2.06
Rural households	82	33.74
Rooms	7	2.88
Suites	1	0.42
Tourist complexes	2	0.82
Tourist facilities	2	0.82
Weekend cottages	9	3.7
Villas	9	3.7
Total	243	100.00

Source: Gašić et al., 2015, p. 76.

Based on the data from the table (Table 1), it can be seen that in the observed period (2014), the largest number of accommodation facilities in rural tourism consisted of rural households (82), suites (50) and guest houses (42).

„Data obtained by the Tourist Organization of Serbia show that rural tourism in the Republic of Serbia is developed in the following villages: Seča Reka, Donji Taor, Ramaća, Kamenica, Borač, Žunje, Lisa, Koštunići, Lopatnica, Gostilje, Jošanica, Kalna, Vrtovac and others. , as well as the fact that a large number of master plans were made with a special emphasis on rural tourism." (Gašić et al., 2015).

According to *the Program for the Development of Sustainable Rural Tourism in the Republic of Serbia* „Official Gazette of the Republic of Serbia", no. 85/2011) in the

development of rural tourism, more important results began in the first decade of the 21st century, in the area of Vojvodina, Central and Western Serbia. Also, the data indicate that in the territory of Serbia in 2010, 145,354 overnight stays in rural tourism were registered. "According to data from the Tourist Organization of Serbia, otherwise obtained by local tourist organizations in Serbia, in 2016 there were a total of 207 categorized rural tourist households in 40 municipalities, which have 752 rooms and 1783 beds. The largest number of categorized rural tourist households is registered in the municipality of Gornji Milanovac, with 47 facilities that have 170 rooms and 395 beds." (Cvijanović, Ružić, 2017).

The Republic of Serbia has numerous predispositions for the development of rural tourism, bearing in mind that it represents a factor in the revitalization of the surrounding rural areas. The development of rural tourism can solve numerous problems that arise, which are related to the depopulation of the population, the departure of young people to cities within the national framework, but also outside the borders of their country, giving up farming, etc. In order to make better use of the comparative advantages of rural areas, rural tourism is being "imposed" as an alternative development option. Development and orientation towards "rural Serbia" can bring numerous advantages, related to: stopping migration flows from rural areas to urban areas, reviving the agricultural sector and other complementary activities, as well as "awakening" dormant, neglected and forgotten traditional crafts.

A large number of villages are located near valuable cultural and historical monuments, which tourists can visit in an organized manner. The buildings of traditional architecture, with the characteristics of a certain area, as well as the products of old crafts and handicrafts, through which the rich heritage of our people is known, have exceptional cultural value. It is also possible to visit various exhibitions that are organized in the area, especially naive paintings, as well as tourist manifestations and traditional events through which people can learn about folk customs and characteristics of village life. (Popesku, 2016). The development of tourist activities in the villages of Serbia does not have a long tradition, because more organized traffic of tourists in this area began to take place from the end of the seventies of the last century (Radonjic, 2011).

Rural households in the surroundings of Ivanjica have the possibility to offer full board, including guests in tourism related to special interests, such as agricultural work, which they do (picking raspberries, collecting hay, etc.), then hunting and fishing through the Hunting Association and the Sport Fishing Association of the municipality Ivanjica, hiking, picking forest fruits and medicinal herbs and other recreational and fun activities in nature (ivatourism.org). On *(Figure 1)* is showed „Golijski Konaci" in the village of Komadine.

Figure 1. „Golijski Konaci“, Komadine village

Source: golijskikonaci.com

“Golijski Konaci” *(Figure 1)* are lodgings located in the village of Komadine, in the municipality of Ivanjica, at the foot of the Nature Park and Biosphere Reserve - Golija. The guesthouses represent a family rural household owned by the Milosavljević family. The complex represents a good example of practice, bearing in mind that lovers of untouched nature are quadricycles in the summer, and snowmobiles, a children’s amusement park in the winter. The hosts also organize trips up to 1833m above sea level - the highest peak of Golija.

“The diversity of natural resources is just one more reason that the development of rural tourism is considered a very important element of sustainable tourism development.” The basis for its development is protected natural resources. So far, 418 natural assets have been protected - 5 national parks, 19 nature parks; 9 landscapes of exceptional beauty; 71 nature reserves; 322 natural monuments, 45 natural assets with historical and cultural characteristics, 215 plant and 427 animal species.” According to estimates by the World Tourism Organization, the share of rural tourism in total tourist trips is between 2 and 4%. This is a very small percentage for our country, and the reason lies in insufficient motivation and low profitability of intermediaries - travel agencies. In a large part of the country, i.e. in rural areas, the cult of hospitality is still cultivated in households. This is also the case with many villages in the Danube region (“Belo Blato”) - which provide domestic and foreign tourists with comfortable accommodation in ethnic houses, through which they revive rural tourism, architecture, as well as the traditions and folklore of their people.” (Tasić, 2018).

As is known, the existence of natural and anthropogenic resources in the rural areas of the Republic of Serbia is not a sufficient condition for the development of rural tourism. (Škorić, 2013). Comparative advantage - what sets the Republic of Serbia apart from the crowd is actually the abundance of natural and anthropogenic treasures, however, what essentially makes it competitive on the international tourist market is the ability to use the available resources in an efficient way in the long term in the function of

tourism, tourists, on the one hand and the local population, on the other hand. Another comparative advantage and opportunity for the development of rural tourism in the Republic of Serbia is the national cuisine and the production of indigenous products produced by family farms located in the rural areas of the Republic of Serbia.

Future trends of rural development in the Republic of Serbia

The modern tourist market is characterized by globalization, which increasingly conditions changes in the market. The changes refer to the continuous development of modern information technologies in order to respond to the specific needs of consumers in the tourism and hotel industry. One of the limiting factors in the development of rural tourism in Serbia is precisely the lack of application of technological solutions and modern ways of doing business. When creating their offer, service providers and other businessmen in tourism should pay special attention to the heterogeneity in tourism, that is, the diversity of their potential consumers and their specific needs and desires. The creation of an individual offer makes it possible to develop a flexible offer that will respond to the needs of specific market segments. The role of modern technology and its application in rural tourism is increasing, so, its growing large-scale trend, the rural tourism product must follow modern information trends.

In the current time and political environment, the opportunities provided by the indisputable value of tourist resources are insufficiently used. Among the weaknesses, the following stand out: lack of finance, poorly built infrastructure, inadequate age structure of the population, lack of receptive capacities, insufficient design of the content of the stay, lack of marketing, management and information system (Čomić, 2002). Among the key trends that business entities encounter on the Internet is the ever-increasing choice of ways to communicate with potential and actual clients. These are meeting points (Touch Points), which exist within every organization or destination, so they also exist outside the organization - on the Internet (Galičić, Laškarin, 2016).

In rural tourism, the benefits of using the Internet can be seen as: more efficient business operations, a tool for researching tourist markets in order to attract potential visitors to rural destinations, creating a more comprehensive tourist offer, facilitating communication between "hosts" - tourist destinations and guests "visiting" rural areas , integrated marketing and promotion of destinations in rural tourism, where modern technologies represent "strategic weapons" without which it is almost unthinkable for rural destinations to create their offer aimed at selected market segments and satisfy their demands and needs in the best possible way. Choosing a tourist destination to be visited is preceded by a series of activities. First of all, it is necessary to develop the awareness of the resident population of the rural destination about the potential it offers, and their permanent education about the provision of services in rural tourism, as well as the awareness of potential consumers about the potential the destination offers. The Internet provides access to all necessary information, and very often represents the first step in realizing a tourist visit. Therefore, the consumer's first contact with the destination is electronic, so great attention is paid to the e-experience. From the perspective of tourists,

the three most significant technological advances that enable easier communication are: communication between tourists and the destination, communication between catering establishments and tourists, and communication between tourists. What often happens is inadequate promotion of the tourist offer. Actors in rural tourism, both providers of rural tourism services, all interested parties - stakeholders for the development of this type of tourism, as well as visitors, who do not have a sufficiently developed "perception" of the amenities and offer of the tourist destination, often face this problem. The success of a tourist destination is to respond to changes in the tourist market and adapt its business to them. This first of all came to the fore during the situation in the world caused by the Covid-19 pandemic. The tourism industry faced a reduction in funds for work, the impossibility of tourist trips, the cancellation of tourist arrangements, the impossibility of flights, etc. Actors on the tourist market, who adapted their offer to the events, managed to "survive" and maintain at least a minimum level of competitiveness - precisely with the right business tools.

Tourists are becoming more educated, want "value for money", and strive for a high level of information. The future direction of the development of rural tourism, in addition to exploiting the potential of insufficiently established destinations, is certainly the use of modern technology.

Rural tourism is based on the principles of sustainable development and direct contact with nature and aims to improve living conditions, protect the environment as a factor of recreation and rehabilitation, create conditions for performing other economic activities, increase the stability of the working population and enable migration in the opposite direction, from urban to rural areas (Loureiro, 2012). The concept of sustainable development is one of the basic concepts of the economy of natural resources and the environment (Milanović et al., 2008). Tourists in rural areas are looking for high quality and untouched environment, peace, silence, sometimes solitude, as well as special kindness and contact with the host, which can be provided by agrotourism as the core product of rural tourism (Cawley, Desmond, 2007). The program for the development of sustainable rural tourism in Serbia was created on the basis of the Tourism Development Strategy of the Republic of Serbia and the National Master Plan for the Development of Rural Tourism, documents of the United Nations Joint Program "Sustainable Tourism in the Function of Rural Development". The program is fully harmonized with the Law on Tourism of the Republic of Serbia. The goal of the program is the development of rural tourism in Serbia for the purpose of diversifying the rural economy, and for the sake of reducing poverty, improving the quality of life, preserving the cultural wealth of the country, protecting the environment and more balanced regional development. This program also aims to make rural tourism in the Republic of Serbia contribute to the overall development of the country's tourism, in accordance with its great potential. Rural tourism has been identified as a key catalyst that can stimulate the rural economy by launching new business initiatives and developing synergies between existing agricultural production and tourism. (Milošević, Milovanović, 2012). The support is also represented by the local population, which increasingly accepts rural tourism as a development opportunity (Mair et al., 2005).

Rural tourism is highly correlated with other types of tourism in the Republic of Serbia, and one of them is sustainable tourism - nature-based tourism, which has recently gained more and more importance, and it is believed that in the future "it will gain even more momentum" " and become a trend on a global level. In that domain, in the future, the aspiration of rural development will be to achieve business based on sustainability, and resource management, in accordance with green business, and other principles of ecological sustainability. According to the Tourism Development Strategy of the Republic of Serbia for the period from 2016 to 2025 („Official Gazette of the Republic of Serbia", no. 85/2014), for the competitive positioning of tourism in the Republic of Serbia, it is necessary to create the product offer in such a way that it is based on modern motives and experiences to tourists who, according to the Matrix for competitive positioning of products by groups and destinations, are listed in the following order: Enjoyment; The nature; Culture, history, customs; Entertainment; Health; Sports, recreation and adventure and business tourism. Cyclotourism (cycling tourism) - this type of tourist offer is divided into several segments: racing bikes, mint bikes, trekking and e-bikes. The oldest is the segment of racing bikes (only 10% of the market, but the share is stable). Around 40% of the market is mountain-bike cyclotourism, where there is a growing trend of interest in fun trails with accompanying content. The largest share of the market belongs to the trekking and e-bike segment, where tourists up to the age of 70 are counted. Cyclotourism does not only mean the existence of bicycle paths, but also very good markings, preferably GPS, then themed paths, bicycle service, accommodation for tourists where they will have a place to store rather expensive bicycles, charging stations for electric bicycles. For the development of this form of offer in the future, the networking of destinations, roads, and accommodation service providers is very important. Bicycle trails are most often categorized according to the difficulty of overcoming individual trails (mountain bike trails, road trails, and paved trails). As a selective form of tourism, bicycle tourism appeared in the second half of the 20th century and will bring people closer to nature. It is based on direct contact with nature, while respecting the principles of sustainability of the natural environment on positive psychophysical influences, and all this with minimal financial investments. Bicycle tourism is a collective name for different ways of using bicycles for tourist purposes, which depends on the adventurous spirit, expectations, lifestyle habits, possibilities and natural environment. Hike & bike geocaching - a combination of a tourist offer, which consists of going on a bicycle trip in "treasure hunting" (geocaching). Also, a fast-growing segment of tourism with potential development in the future (Galičić, Laškarin). Bird watching - The Republic of Serbia has conditions for the development and promotion of bird watching tourism. This type of activity can greatly contribute to the sustainable development of the reserve, to enable a stay in nature, and at the same time make the stay more meaningful for visitors to rural destinations.

Conclusions

Despite the rich resource base, rural tourism in the Republic of Serbia is in the initial stage of development. Fragmented and dispersed peasant holdings, orientation towards other types of tourism and mass tourism, insufficiently developed awareness of the value of the

environment, are just some of the factors that have influenced the weak development of rural tourism. Also, the weak appearance of rural tourism in the tourist offer of the Republic of Serbia has influenced such a situation (Todorović, Bjeljac, 2007; Luković et al, 2022).

The Republic of Serbia, with its numerous predispositions for the development of rural tourism, is a factor in the revitalization of the surrounding rural areas. The success of a tourist destination is to respond to changes in the tourist market and adapt its business to them. This first of all came to the fore during the situation in the world caused by the Covid-19 pandemic. The tourism industry faced a reduction in funds for work, the impossibility of tourist trips, the cancellation of tourist arrangements, the impossibility of flights, etc. Actors on the tourist market, who adapted their offer to the events, managed to "survive" and maintain at least a minimum level of competitiveness - precisely with the right business tools.

Serbia has discovered opportunities, on the one hand, and unconfirmed potentials, on the other. It is of crucial importance to develop awareness both among potential visitors and among all parties interested in the development of rural tourism. In order to achieve this, it is necessary to continuously monitor changes in the market, contemporary trends, and those trends that make the future of rural and tourism in general.

Conflict of interests

The authors declare no conflict of interest.

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Acknowledgements

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The authors declare no conflict of interest.

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2. Hjalager, A. M., & Richards, G. (Eds.). (2003). *Tourism and gastronomy*. Routledge, London.
3. Mićović, A. (2017). Tourism Development and Evolution of Tourism Related Rules, *2nd International Scientific Conference – Thematic Proceedings II*, Faculty of Hotel Management and Tourism, Vrnjačka Banja, 181-202. Retrieved from http://www.hit-vb.kg.ac.rs/conference/images/thematic_proceedings/2017_II.pdf
4. Stošić, L., & Stošić, I. (2013). Diffusion of innovation in modern school. *International Journal Of Cognitive Research In Science, Engineering And Education (IJCRSEE),* 1(1), 12-24.

5. Domanović, V., Vujičić, M., & Ristić, L. (2018), Profitability of food industry companies in the Republic of Serbia, *Economic of Agriculture*, 65(1), 11-32. doi:10.5937/ekoPolj1801011D
6. The Food and Agriculture Organization of the United Nations (FAO), Retrieved from http://www.fao.org (July 31, 2018)

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Example:

Table 1. The distribution cost of packaged goods from Subotica to retail-store objects

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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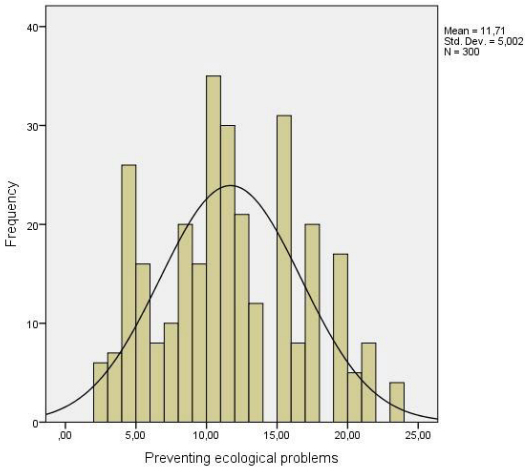
Figure 1. Agriculture, value added (% of GDP)



Source: Authors' calculations

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