UDC 338.43:63

ISSN 0352-3462

ЕКОНОМИКА ПОЉОПРИВРЕДЕ

ECONOMICS OF AGRICULTURE

Vol. LXX, №1 (1-344), 2023

BELGRADE

UDC 338.43:63

ISSN 0352-3462

ЕКОНОМИКА ПОЉОПРИВРЕДЕ
ECONOMICS OF AGRICULTURE

Journal is indexed and abstracted in Emerging Sources Citation Index.

70.

"Сагласно одлуци из члана 27. став 1. тачка 4), Закона о научноистраживачкој делатности („Службени гласник РС", бр. 110/05, 50/06-испр. и 18/10), утврђена је категоризација домаћих научних часописа

Листа часописа за друштвене науке

5. Економика пољопривреде М24"
(Часопис међународног значаја)
http://www.nauka.gov.rs (28. Jun 2010)

Београд, јануар - март 2023. године
Belgrade, January - March, 2023

Часопис
◊ ЕКОНОМИКА ПОЉОПРИВРЕДЕ ◊

Journal
◊ ECONOMICS OF AGRICULTURE ◊

Основан 1954. године / Established 1954

ИЗДАВАЧИ / PUBLISHERS

Научно друштво аграрних економиста Балкана, Београд
The Balkan Scientific Association of Agrarian Economists, Belgrade
Институт за економику пољопривреде, Београд (Србија)
Institute of Agricultural Economics, Belgrade, (Serbia)
Академија економских наука, Букурешт (Румунија)
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

http://ea.bg.ac.rs

UDC 338.43:63 ISSN 0352-3462

ECONOMICS OF AGRICULTURE

CONTENT

RESPONSIBILITY FOR MATERIAL DEFICIENCIES OF GOODS, WITH REFERENCE TO ORGANIC PRODUCT

Ljiljana Rajnović[1], Nenad Mihailović[2], Snežana Cico[3]

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

ARTICLE INFO

Original Article

Received: *09 March 2022*

Accepted: *10 October 2022*

doi:10.59267/ekoPolj230113R

UDC 658.62:631.47

Keywords:

product defects, customer rights, seller responsibility, organic production, organic production methods.

***JEL**: K12, K32, L11, L14, N50.*

ABSTRACT

In this paper, the authors discuss the responsibility for material deficiencies of goods, with reference to the organic agriculture products, given the specific and highly demanding production system and the growing demand for organic products in developed countries and in Serbia. An integral part of everyday life is the risk that the goods purchased are more or less materially defective. Organic production methods involve the usage of natural processes and substances, and limit or completely eliminate the use of synthesized agents. Also, producers inevitably suffer from various external influences. The desire of consumers is to buy products which use natural ingredients that are obtained on the basis of natural procedures. Research in this paper has shown that in the creation of an organic product may occur material defects that more or less impair its essence. Therefore, this paper analyzes such shortcomings and also recommends how customers can act when they find themselves in this situation.

Introduction

In this paper, the authors analyze the material defects of the item with reference to the organic plant product for which the seller is responsible, in cases where there are material defects, having in mind the specifics of the organic production process, types of defects, and the rights of the buyer if there are material defects on the purchased item.

The responsibility of the seller (transferor) for items with a material defect is a general rule and an important instrument that ensures the protection of the interests of the buyer (Law on Contracts and Torts: ZOO, Law on Consumers Protection). Broadly speaking,

1 Ljiljana Rajnović Ph.D., Senior Research Associate, Institute of Agricultural Economics, Volgina 15, 11000 Belgrade, Serbia, Phone: + 381 63 273 237, E-mail: rajnoviclj@gmail.com, ORCID ID (https://orcid.org/0000-0002-8209-9088).

2 Nenad Mihailović, MA., Asistent, Academy of Vocational Studies Western Serbia, ul. Svetog Save br. 34, 31000 Užice, Serbia, Phone: +381 63 251 192, E-mail: nenad.mihailovic@vipos.edu.rs, ORCID ID (https://orcid.org/0000-0002-3307-2686).

3 Snežana Cico Ph.D., JKP Prostor, Cara Lazara 1, 25101 Sombor, Serbia, Phone: + 381 64 44 02 057, E-mail: snezanacico@gmail.com, ORCID ID (https://orcid.org/0000-0003-3356-6767).

the basis of this responsibility, considering its practical significance, is also based on the principle of equal value of benefits (the principle of equivalence of obligations) in a bilateral freight contract (Goldštajn, 1967).

Material defects exist if the sold item (product) does not have properties for its regular, usual use or trade, as well as when the item does not have the required properties for special use for which the buyer procures it, and the seller knew it or must have known it. There are also material defects if the item does not have the properties and characteristics that are explicitly or tacitly agreed between the parties, or prescribed, but also when the seller handed over the item that does not comply with the sample or model, unless the sample or model was used only to inform the other contracting party.

Contrary to the above, the seller is not liable for defects if they were known as such to the buyer at the time of conclusion, or could not remain unknown to him.

If the defects in the items are visible, they should be discovered during the usual inspection which the buyer is obliged to perform, or the item may be given for inspection to another qualified person, as soon as possible according to the regular course of things. The buyer is obliged to inform the seller about the visible shortcomings within eight days, and in the case of a contract in the economy immediately, otherwise he loses rights that belong to him on that basis (ZOO).

If it turns out, after receiving the item from the buyer, that the item has a defect that could not be detected by the usual inspection, then it is about a hidden flaw. As in the case when there are visible defects, the buyer is obliged, under the threat of losing the right, to inform the seller about that defect within eight days, but counting from the day when he discovered the defect. In the case of a contract in the economy, the buyer must inform the seller without delay. The buyer is obliged to describe the defect in more detail to the seller in the notice of defect and invite him to inspect the item.

The seller is not responsible for defects that appear after the expiration of six months from the delivery of the goods, except when the contract stipulates a longer period (ZOO). In the case of agreements on the international sale of goods, this period is two years (United Nations Convention on Contracts for the International Sale of Goods, 1980).

As organic production is a demanding, complex and comprehensive food production management system that combines best environmental practices, high levels of biodiversity (Paull, 2011), conservation of natural resources and the application of high standards (Book of Recommendations of the National Convention on European Union 2015), and the production method is in line with the desire of a particular consumer to buy products that use natural ingredients, which are obtained on the basis of natural processes (Kuepper, 2010; Popescu et al., 2019) while production is subject to external adverse effects with which the manufacturer can not always manage, there are great opportunities that an organic product has flaws, visible or hidden.

Material defects of the product

The transferor in the cargo contract is responsible for the material defects of the thing that it had at the time of transferring the risk to the acquirer, regardless of whether he was conscientious, or whether he was aware of the existence of defects. The transferor is also liable for those material defects that occur after the transfer of risk to the acquirer, if they are the result of a cause that existed before (ZOO; Perović, 1995).

The transferor is liable to the acquirer for material defects of the thing under certain conditions, which must be cumulatively fulfilled:

- the existence of product defects,
- concealment of shortcomings,
- the existence of a defect at the time of the transfer of rights,
- timely notification of the transferor by the acquirer.

The existence of product defects - The basic presumption of the carrier's liability is the existence of a material defect in the product. A defect is considered to exist if item does not correspond to the usual quality i.e. if it cannot be used in the usual way, on the one hand, and if it cannot be used in the manner specified in the contract between transferor and acquirer, on the other. In essence, material defects are those defects that affect the cause of the contract itself. Minor material defects are not taken into account (Čubrilo et al., (1979).

According to the provisions of the ZOO, material deficiencies exist in the following cases:

- if the thing does not have the necessary properties for its regular use or for trade
- if the thing does not have the necessary properties for its special use for which the acquirer procures it, and which was known to the transferor, or must have been known
- if the thing does not have the properties or characteristics that have been agreed upon, explicitly or tacitly
- when the transferor has handed over an item that does not comply with the sample or model, unless the sample or model is shown for information only.

Concealment of shortcomings - The principle of conscientiousness and honesty implies the appropriate behavior of both, the transferor and the acquirer of things. This means that the acquirer should also inspect the item he is acquiring with the usual care, which can be used to determine the existence of visible defects, i.e. defects, such as physical damage, etc. However, the situation is not the same when it comes to the classic contractual obligation between natural persons and the legal persons. If the examination of things includes certain professional knowledge, the acquirer in the contract in the economy, should also provide a basic examination which will be performed by experts of the appropriate profession. (Čubrilo et al, 1979; Milojević et al., 2020). There are often hidden flaws in things. When, after receiving the goods from the acquirer, it is determined that there is a defect that could not be determined by the usual inspection

during the takeover, then it is about a hidden defect of the thing. In such a case, the acquirer is obliged to inform the transferor about the defect, who is responsible for the defects regardless of his conscientiousness, i.e. whether or not he knew of the existence of deficiencies.

Existence of a defect at the time of transfer of rights - In the legal system of Serbia, the transferor is liable for material defects of the thing, regardless of his conscientiousness. So, the transferor is responsible for those shortcomings that the thing had at the time when it was in his possession. However, the transferor is responsible for those material defects that occur after the transfer of risk to the acquirer, but under condition that they are a consequence of the cause that existed before (ZOO; Perović, 1995) .

Timely notice - If the items are inspected in the presence of the representatives of both contracting parties, the acquirer is obliged to put remarks od the visible shortcomings immediately, otherwise he loses the right that belongs to him on that basis. In the event that the acquirer dispatches the item further (e.g. for resale), and the transferor knew or should have known about such shipment at the time of concluding the contract, the inspection of the item may be postponed until its arrival at the new destination. In that case, the acquirer is obliged to inform the transferor about the defects of the items as soon as, according to the regular course, he had to find out about them. The transferor will also be liable for a visible defect, if he stated to the acquirer that the items have no defects, and the acquirer is obliged to inform the transferor within eight days about visible defects, and in the case of trade contracts, without delay (Perović, 1995).

In the case of hidden defects, the transferor is liable for material defects if the transferee informs him about it within a subjective period of eight days, and in trade contracts without delay, because otherwise, the transferor loses the right to protection. However, the transferor will not be liable for hidden defects that appear after the expiration of six months from the sale of the item, when it comes to the objective deadline, unless a longer deadline is agreed. If the item was handed over for repair due to defects, or another item was delivered, replacement of parts or similar, these deadlines start to run from the delivery of the repaired item, delivery of other item or similar.

Characteristics of organic production

Agriculture, as the most important strategic economic branch, aims to produce quality and safe food for humanity as well as natural cycles necessary for the survival of life on earth. Unlike conventional production, organic production is based on the biological balance of the system. One of the basic principles of organic production is perhaps best illustrated by the importance of organic products: healthy soil - healthy plants and animals - healthy people (Book of Recommendations of the National Convention on the European Union 2015).

Organic production methods include a system of sustainable agriculture based on high respect for environmental principles, rational use of natural resources, use of renewable energy sources, conservation of natural diversity and environmental protection (Paull,

2006). Therefore, organic production is currently the fastest growing food sector in developed countries, with a significant impact on the creation of new quality of life, human health, quality of the environment and plant communities.

Organic production is production with many restrictions and prohibitions in the process of production and transport of organic products. The use of genetically modified organisms, artificial colors, sweeteners, flavor enhancers, synthetic plant protection products, preservatives, etc. is prohibited. For example, in the processing of raw materials in conventional production, the use of about 390 additives is allowed, and in organic only 49.

In addition to the above, the process of organic production is also influenced by external factors. These are elements of the external environment, over which the manufacturer has no control, can not affect the way they will be formed (Rajnovic, 2021) or their appearance, such as pollution of water, environment, land, natural disasters. They can present opportunities or threats to the manufacturer, depending on the form in which they appear.

The basic principles for the development of organic agriculture were set by the International Federation of Organic Agriculture Movements (IFOAM, 1972.), International organization for organic production, which was founded in 1972. These standards are based on European Union regulations, then the Codex Alimentarius, as well as the Law on Organic Production and Organic Products of the Republic of Serbia.

The basic principles on which organic agriculture is based according to IFOAM are:

- principle of health - organic agriculture should maintain and increase the health of people, plants, animals, land and the planet as a whole (Wheeler, S. A. (2008),
- principle of ecology - organic agriculture should be based on living eco-systems and cycles, to support them and help maintain them (Emsley, J. 2001),
- principle of justice - organic agriculture should be based on fair relations with the general environment, nature and life,
- the principle of nurturing and caring - organic agriculture should be managed in a prudent and responsible way to preserve the health and well-being of present and future generations and ecosystems.

Aim of the paper and methodology used

For the purposes of this paper, the authors conducted an interview with 26 entities engaged in organic production for the territory of Vojvodina, from which 22 are entrepreneurs and 4 are small legal entities. All of them have been involved in organic plant production for at least ten years and all of them are members of an association of organic producers. All entities are regularly educated in this field.

The following methods were used in the research of the topic in question, in order to collect and evaluate relevant information:

- producer's interviews as a descriptive method, which show what kind of product deficiencies have occurred in the producer's practice so far and that the observed cases can be taken as typical cases,
- the comparative method enabled the authors to come to generalizations or new conclusions by comparing the same or similar phenomena or establishing similarities and differences between them,
- method of synthesis, was used in the end to summarize the conclusions at the level for the territory of Republic of Serbia, with recommendations for efficient and effective resolution of the consequences of the sold organic product with shortcomings.

From the analysis of all collected data, the authors came to the conclusion that, given that Serbia is a predominantly rural country with an unpolluted agricultural system, due to the use of smaller amounts of chemicalization, which means that organic products with quality deficiencies do not appear in production. Quality is the basic feature of an organic product, without which an organic product would not have defined properties.

To a lesser extent, there are products with material and physical defects, mainly physical damage caused in transport or due to other external influences.

Research results

According to the data from 2011, organic production was applied in 120 countries in the world and has been developing very fast until today. Over the last decade, the volume of organic production in the world has increased significantly, so that on a global scale, organic production covers more than 26 million hectares of agricultural land (www.organic-world.net). Sales of organic products in the world are increasing from year to year. The most important markets for organic food are the United States, Canada, Europe and Japan. The largest consumers of organic food in Europe are Germany, Great Britain, Italy and France (Organic production in Serbia 2020).

According to data from 2011, the countries with the largest organic areas are Australia (11.8 million hectares), Argentina (3.1 million), China (2.3 million) and the United States 1.6 million hectares). The percentage of areas under organic production in relation to the area of the country shows a completely different situation because in the first ten countries of the world only European countries are represented: Liechtenstein (26.4%), Austria (12.9%) and Switzerland (10.27). The tendency of development of organic production in the countries of Central and Eastern Europe is more and more pronounced (www.organic-world.net).

Serbia is a country that is at the very top of other countries in terms of the area of land on which it is possible to apply organic production, since Serbia is full of regions that practically represent "untouched nature". There is a possibility to immediately include these areas in organic production without the flow of time required for conversion, which is a great advantage. According to official data for 2011, organic production in Serbia took place on an area of 2,860 hectares. This data also includes areas used

for the collection of wild fruits, mushrooms and medicinal plants (Organic Production in Serbia, 2013). Organic production in Serbia is becoming increasingly popular and economically important. In 2019, the area of land under organic plant production was 21,264 ha (Organic production in Serbia 2020). Organic production can significantly contribute to the development of rural areas and agriculture in general, which is why it is set as one of the priorities of agricultural development and is an integral part of the strategy for rural and agricultural development of Serbia.

Research in practice

For the purposes of this paper, the authors conducted an interview with 26 people engaged in organic production in Vojvodina, of which 22 are entrepreneurs and 4 small companies. All have been involved in organic plant production for at least ten years and all are members of an association of organic producers. All persons are regularly educated in this field.

The research was conducted in a period of three years, from 2019 to 2021. In the observed period, there was a minimum amount of defective products, of which about 90% were physical defects caused by harvesting, transport or transshipment of products and only in one case in one agricultural year an insignificant amount of products with a qualitative deficiency appeared, in the case of seed wheat. This shortcoming was immediately noticed by the buyer of the product, who immediately filed a complaint, i.e. immediately after the vegetation and the classification of seed wheat. There were no other qualitative shortcomings of the product.

In order to research this topic in the case of organic products, it was necessary to determine:

- were there any product defects,
- type of deficiencies: physical or qualitative?

Table 1. Deficiencies of organic products in the observed period

Serial number	Product type	Kind of a defects		No flaws	Period of observation		
		Physical	Qualitative		2019.	2020	2021
1.	Seed wheat		Qualitative		Yes	No	No
2.	Broccoli	Physical			Yes	Yes	Yes
3.	Raspberries	Physical			Yes	Yes	Yes
4.	Strawberries	Physical			Yes	Yes	Yes
5.	Cherries	Physical			Yes	Yes	Yes
6.	Walnut			No	No	No	No
7.	Hazelnut			No	No	No	No

Source: Research of Authors.

Possible shortcomings of the organic product and responsibility for the shortcomings

Agriculture is the primary branch of the economy, present in all economic and political systems that accompany people, in all climatic zones and regions. The activity of agriculture, everywhere of the world, in addition to the factors and phenomena created by people, is determined by the conditions created by the forces of nature. Agriculture has a dual role: it needs to find a way to produce quality food for the population and at the same time take care of nature while preserving biodiversity (Rajnović et al., 2020; Micić et al., 2022). Ecologically sustainable agriculture that uses natural resources wisely is essential for food production and the quality of life of people. For all that, agriculture needs a material basis and permanent acquisition of new knowledge all the time of business (Cico et al., 2021).

Organic production is fully controlled production, the conditions of which must be adapted to the specific conditions of the country in which the production takes place (OECD, 2013). In order to develop organic production in a certain area, it must meet precisely set goals, namely: isolation of land, livestock farms and processing facilities from possible sources of pollution, adequate quality of irrigation water, coordinated development of plant and livestock production, ability of producers to production of organic products with the obligation of continuous improvement in this area (IFOAM, 1972). In order to preserve economic benefits with reduced application of chemicalization, it is necessary to use natural resources with the greatest care, especially pastures and meadows (FAO, 2010).

Since in the developed countries of the world, modern agriculture with aggressive application of all available chemicals has led to the deterioration of air, water and soil quality, it is almost impossible to establish organic production because it would lead to irreversible quality deficiencies of organic products. Due to that, there is a lack of organic products in those countries. Therefore, less developed countries, where the game system is still preserved, have the opportunity to develop organic production without qualitative shortcomings.

As the conditions for organic production are highly demanding, which can be affected by unforeseen external influences, an organic product can have visible or hidden shortcomings. The essential shortcomings of the organic product are certainly the qualitative shortcomings, because quality is the basic feature of these products and at the same time the reason why the consumer buys them. In this paper, the authors analyze the position of the contracting parties when the transferor sells a defective product, in which case the buyer's right is at the same time the seller's obligation.

Protection effect - When a seller sells a defective product, the question arises as to how the buyer's interests are protected. The goal of protection must be the correction of these disorders, in order for the contract to remain in force (ZOO; Perović, 1995). For this purpose, various legal instruments can be used, namely: the duty of the transferor to eliminate the defect at the request of the acquirer; the duty of the transferor to replace

defective generic items; contract termination; compensation for damages. Based on the mentioned legal instruments, two basic systems of protection of the buyer's interests are envisaged in foreign law.

The first system, which has its basis in Roman law, involves the possibility of applying two lawsuits:

- *Actio redhibitoria*, which demanded the termination of the contract of sale and a refund of the price paid, due to hidden defects that diminished the value of the thing, or excluded the normal use of the thing,
- *Actio quanti minoris,* was raised for the same reasons, but when the buyer did not want the termination, but the survival of the contract, in which case he was entitled to a certain price reduction.

The second system differs from the first in that the acquirer has no *ius optionis,* because the survival and termination of the contract is decided by the court, taking into account the circumstances of the case and the relevant legal standards. In this system, too, the acquirer is protected by appropriate legal instruments, but he cannot choose them at will. In this case, the termination of the contract can occur if the shortcomings are such that they cannot be eliminated, or significantly hinder the use of things, i.e. when it comes to major shortcomings. In case of minor defects, the acquirer cannot request the termination of the contract, but only a proportional reduction of the price, repair of the item or supplementation of what is missing. The acquirer will also be entitled to compensation for damages, and its amount will depend on his conscientiousness, as in the first system.

In addition to these two, there is a third system, mixed, which is accepted in Serbian law and starts from the idea that such a measure should be found, which will not give preference to either the transferor or the acquirer, as the previous two systems give, which means a combination of the previous two systems. Accordingly, the buyer who has timely and properly notified the seller of the material defect of the product has the right to request: fulfillment of the contract, price reduction, termination of the contract and compensation for damages (ZOO).

Fulfillment of the contract implies the right of the buyer to demand from the seller to remove the defect or hand over other things without defect, while the solution which implies lowering the price means the survival of the contract, but also changing its essential element, i.e. price.

In addition to these rights, the buyer is also given the right to terminate the contract. However, this right may be excluded by the contract, but the acquirer, who waived the right to terminate the contract due to physical defects, retains all other rights. In order to exercise this right, the acquirer must allow the transferor a subsequent reasonable time to perform the contract (Perović, 1995). An exception to this condition is also provided. Namely, if the transferor informs the acquirer that he will not fulfill the contract even after the notification of defects, or if the circumstances of the specific case obviously

show that the seller will not be able to fulfill the contract even later, the acquirer may terminate the contract without leaving a deadline.

If only a part of the delivered item has defects, the acquirer may terminate the contract, but only in the part that has defects, or in respect of the missing part. The acquirer will lose the right to terminate the contract due to physical defects if it is impossible to return the item, or the inability to return the item in the condition in which it was at the time of receipt. If the thing has failed in whole or in part, or has been damaged due to a defect that justifies the termination of the contract, the law gives the acquirer the possibility to terminate the contract (Krulj, 1972). The acquirer may terminate the contract if the item is completely or partially lost, or is damaged due to the buyer's obligation to inspect the item, or if the customer spent or changed part of the item during its regular use before the defect was discovered, as well as in cases where damage or alteration slight.

Consequences - With the termination of the contract due to the existence of material deficiencies, the cause of mutual services ceases to exist, which means that the party who fulfilled his service will have the right to restitution, ie both parties will have the right to restitution if they performed their actions. In doing so, each party will be obliged to reimburse the benefits it has received from the use of the items (Perović, 1995).

The agricultural insurance market in Serbia is characterized by a small percentage of insured areas and unfavorable agricultural insurance structures because one-case insurance dominates, most often from the hail, while insurance against other risks in Serbia is not available (Vasiljevic et al., 2020; Andrei, & Darvasi, 2012). Due to that, the compensation for the damage to the buyer, in Serbia, is mostly borne by the seller.

Exercising the right on the basis of the institution of material defects of things, involves two types of deadlines: timely notification of the transferor by the acquirer of the existence of defects and timely filing of a lawsuit by the acquirer:

- timely notification of the transferor by the acquirer of the existence of defects is related to short deadlines. The notification should follow the discovery of the defects without delay, because in this way, it seems certain that there is a defect and eliminates the possible greater damage that may occur due to the functioning and use of the defective item. Serbian law provides for a subjective deadline for notifying the transferor, which is eight days from the day the defect was discovered, if it is a hidden defect. In addition to the subjective, there is also an objective deadline of six months from the delivery of the item (Krulj, 1972). The transferor is not responsible for deficiencies that appear after this deadline. However, this objective deadline also depends on one subjective circumstance, namely the conscientiousness, ie negligence of the transmitter. If the transferor knew, or should have known about the defect, then the transferee does not lose the right to protection even when he did not inspect the item without delay, ie when he informed the transferor within eight days, and even when the defect became apparent after six months (Perović, 1995).

- timely filing of a lawsuit by the acquirer, with the merits of the lawsuit, is a condition for success in the dispute. In the law of Serbia, two situations are envisaged: the first, when the acquirer fulfilled his performance, and the second, when he did not fulfill his performance. In the first case, the rights of the acquirer, who promptly informed the transferor of the existence of a defect, shall cease after one year from the date of dispatch of the notice to the transferor, unless his fraud prevented the transferor from using them. In the second case, the acquirer who has timely notified the transferor of the existence of a defect and has not yet paid the price, may, after one year, file a request to reduce the price or compensate him for the damage, as an objection to the transferor's right to demand fulfillment of the acquirer's performance (ZOO; Perović, 1995).

Deviation from the legal rules of protection in case of physical defects of the product

Provisions on protection due to the sale of defective items are of a dispositive nature, so that legal regulations enable the contracting parties to regulate their mutual rights and obligations differently, but the negligence of any contracting party cannot be tolerated, nor can the functioning of basic legal instruments.

When it comes to physical defects, the contractors can expand, reduce or limit, but also exclude the liability of the transferor. According to the law of Serbia, the contractors can limit or completely exclude the seller's liability for material defects of the thing, but under the condition of the conscientiousness of the transferor, because otherwise, such provisions will be null and void (ZOO; Perović, 1995).

In the case of a voluntary public offer, all the rules of the seller's liability for both legal and physical defects apply, while in the case of a forced public sale, the holder whose item was sold is not liable for defects.

Amount of compensation for material damage

The scope of compensation includes everything that reduced the property of the injured party due to the damage, including actual damage, lost profit, as well as all other costs caused by the harmful event, such as costs of transporting goods, interest on lost funds to eliminate the consequences of damage and similarly. The injured party is entitled to compensation for ordinary damage, but also to compensation for lost profits, and the principle of integral compensation applies to its amount.

In the case of contractual liability for damage, the degree of guilt should be taken into account: in the case of ordinary negligence of the pest, the actual damage and lost profits are limited to foreseeable damage; when it comes to fraud, intent and gross negligence, the seller owes the entire damage; if the creditor has incurred any gain due to causing damage, it will also be taken into account when determining the amount of damages.

The amount of damages is determined according to the prices at the time of the court decision, except when otherwise provided by law. When assessing the amount of lost profits, the profit that could reasonably be expected according to the regular course of events or according to special circumstances, and the realization of which is prevented by the pest's action or omission, is taken into account. If the thing was destroyed by a criminal act committed with intent, the court may determine the amount of compensation according to the value that the thing had for the injured party.

The court will award compensation in the amount necessary to bring the injured party's property situation to the state in which he would have been if there had been no harmful act or omission. In certain cases, the court may order the responsible person to pay less compensation than the amount of damage, which will be the case when the damage was not caused intentionally or with gross negligence and the responsible person is in poor financial condition, which is why the payment of the full amount of damage would bring him into poverty. Reduction of compensation is also possible if the pest caused damage by doing something for the benefit of the injured party, whereby the court takes into account the degree of attention that the pest shows in its own affairs. When making a decision on reducing the compensation, the court must also take into account the condition of the injured party's property.

In the case of shared responsibility for causing damage, the injured party who contributed to the damage occurring or being greater than it would otherwise be, is entitled only to a proportionately reduced compensation.

Conclusion

This paper analyzes the legal institutes most important in the field of trade in defective products, especially when the subject of trade is an organic plant product, for the production of which there are significant potentials in Serbia, given that it has numerous places of ecologically clean natural conditions needed for organic production. The analysis was performed from the aspect of domestic and comparative law, as well as international uniform rules, with special emphasis on their application in practice.

Conditions for organic production are highly demanding, based on the use of crop rotation, compost and biological control of insects, green manure. Organic production involves the use of fertilizers and pesticides that are considered natural. Methods of organic agricultural production are internationally regulated and implemented by many countries, and are based on standards established by IFOAM, with the aim of establishing sustainable development, conservation and health and safety, which are the main reasons for the introduction of organic production.

The quality of an organic product is an essential motive for purchase by consumers, because quality is the basic feature of an organic product. This flaw is usually a hidden flaw. In this paper, the authors analyze the position of the contracting parties in a situation where the transferor sells a defective product, in which case the buyer's right is the seller's obligation.

In this period of research, the authors found that in practice there is a minimum amount of defective products, of which about 90% are products with physical defects, which were mainly created during harvesting, transport or transhipment of products and only in one case in one agricultural year a small amount of products with a qualitative deficiency appeared, in the case of seed wheat.

The liability of the seller (transferor) for defective items is a general rule and an important instrument that ensures the equivalence of the obligations of the contracting parties in a bilateral cargo contract. Therefore, the transferor, in the case of delivery of defective goods, is obliged to compensate the buyer for the damage suffered at the request of the buyer. Of course, the rules determined by law in this matter can be regulated in a different way by an agreement between the seller and the buyer.

Acknowledgement

Paper is the result of research financed by Ministry of Education, Science and Technological Development of the Republic of Serbia.

Conflict of interests

The authors declare no conflict of interests.

References

1. Andrei, J. V., & Darvasi, D. (2012). Perspectives and challenges in financing the new Common Agricultural Policy, a new paradigm. *Journal of Food, Agriculture & Environment*, 10(1 part 2), 904-907.
2. Book of Recommendations of the National Convention on the European Union, (2015), National Convention on the European Union, *Norwegian Embassy*.
3. Cico, S., Rajnović, Lj., Bošnjak, I., (2021), Organizational restructuring as a way to resolve the crisis caused by Covid 19 in agricultural sector, *Agricultural Economics* No 3, Publishers: Scientific Society of Agrarian Economists of the Balkans Belgrade, Institute of Agricultural Economics Belgrade, Academy of Economic Sciences Bucharest, Romania, p. 611-627.
4. Consumer Protection Law („Official Gazette of RS,, No 88/2021).
5. Emsley, J. (2001), Going one better than nature, Nature, 410 (6829): p. 633—634. doi:10.1038/35070632.
6. FAO (2010): Medium – term prospects for agricultural commodities, Projection of the year 2010, Rome 2005, *Food and Agriculture Organisation of the United Nations.*
7. *German Organization for International Cooperation (GIZ)*, Organic production in Serbia, (2013), p. 12.
8. *German Organization for International Cooperation (GIZ)*, Organic production in Serbia, (2020), p. 19.

9. Goldštajn, A., (1967), Commercial Contract Law, Newsletter, *Newspaper and Publishing Institute,* Zagreb.
10. IFOAM**:** (1972), International Federation of Organic Agriculture Movements.
11. Krulj, V., (1972), Actions of the sales contract, *Law Faculty,* Belgrade.
12. Kuepper, G. (2010), A Brief Overview of the History and Philosophy of Organic Agriculture, Kerr Center for Sustainable Agriculture.
13. Law on Obligations ("Official Gazette of SFRJ", No 29/78, 39/85, 45/89 – decision od USJ i 57/89, "Official Gazette of SRJ", No 31/93 i " Official Gazette of SCG", No 1/2003 - Constitutional Charter).
14. Law on Organic Production („Official Gazette of RS„ No 30/2010).
15. OECD, Organic Agriculture: Sustainability, Markets and Policies, CABI International. 2003.
16. Mićić, R., Staletović, M., & Kojić, N. (2022). Social responsibility in modern trade companies with reference to the walmart trade chain. *Oditor*, *8*(1), 37-62. https://doi.org/10.5937/Oditor2201036M
17. Milojević, I., Mihajlović, M., & Pantić, N. (2020). Collection and documentation of audit evidence. *Oditor*, *6*(2), 77-90. https://doi.org/10.5937/Oditor2002077M
18. Paull, J., (2006), The farm as organism: The foundational idea of organic agriculture, Journal of Bio-Dynamics Tasmania, 83: p. 14-18.
19. Paull, J., (2011), Nanomaterials in food and agriculture: The big issue of small matter for organic food and farming, Proceedings of the Third Scientific Conference of ISOFAR (International Society of Organic Agriculture Research), 28 September - 1 October, Namyangju, Korea, 2:96-99.
20. Perović, S., (1995), Commentary on the Law on Obligations, Savremena administracija d.d. Belgrade.
21. Popescu, G. H., Andrei, J. V., Nica, E., Mieilă, M., & Panait, M. (2019). Analysis on the impact of investments, energy use and domestic material consumption in changing the Romanian economic paradigm. *Technological and Economic Development of Economy*, 25(1), 59-81.
22. Rajnovic, Lj., (2021), Contracts in the economy with reference to external influences on the contractual relationship, *Institute of Agricultural Economics,* Belgrade.
23. Rajnović, Lj., Snežana, C., Zoran, B., (2020), Restitution of Agricultural Land in Serbia - Comparative Legal Aspects, *Agricultural Economics*, Publishers: Scientific Society of Agrarian Economists of the Balkans, Belgrade, Institute of Agricultural Economics, Belgrade, Academy of Economic Sciences, Bucharest, Romania, p.p. 1355-1366, doi: 10-5937/ekoPolj2004353R.
24. Simić, I. (2020) Organic production in Serbia 2020, Publisher: National Association for the Development of Organic Production, Serbia Organica, p. 24-25.

25. United Nations Convention on Contracts for the International Sale of Goods of 1980, *Official Gazette of the SFRY* - International Agreements No 10/1.
26. Čubrilo, B., Zeković, T., (1979), Responsible for material defects and guarantees for the proper functioning of the sold items, Contractual and indemnification law under the Law on Obligations - Proceedings, Belgrade, p. 291.
27. Vasiljević, Z., Radović, G., Kovačević, V., (2020), Innovations in risk management in agriculture, In: The importance of development research and innovation in the function of improving agriculture and forestry in Serbia, Academy of Engineering Sciences of Serbia, Department of Biotechnical Sciences, Belgrade, p. 120-128.
28. Wheeler, S. A. (2008), What influences agricultural professionals' views towards organic agriculture?, Ecological Economics, 65: 145-154, doi:10.1016/j.ecolecon.2007.05.014.
29. Available at: www.organic-world.net, retrieved: 20.12.2020.

RESEARCHING TRENDS AND FORECASTING FUTURE VALUES OF FRUIT EXPORTS AND IMPORTS OF THE REPUBLIC OF SERBIA

Biljana Stankov[1], Milijana Roganović[2], Milan Mihajlović[3]

**Corresponding author E-mail: milan.mih83@gmail.com*

ARTICLE INFO

Original Article

Received: *18 May 2022*

Accepted: *15 July 2022*

doi:10.59267/ekoPolj230129S

UDC 339.562+339.564]:634.1/.7(497.11)

Keywords:

foreign trade, import, export, fruit and fruit products, linear trend

***JEL**: Q17, F17*

ABSTRACT

Considering that the Republic of Serbia has a surplus in the foreign trade of fruits, the problem of this research refers to the perception of the importance of the foreign trade of fruit of the Republic of Serbia. The subject of the research includes the analysis of previous and future trends in the value of exports and imports of fruits, as one of the most important agro-industrial products. The aim of the research is to determine future trends, as well as to forecast future values of fruit imports and exports using econometric methodology in the field of analysis of variations of time series, i.e. statistical methods of linear trend. The contribution of this research study is multiple, in scientific terms it enriches the existing scientific literature, given that research studies that have addressed this issue are very rare, while in practical terms it provides guidance to producers and exporters of fruits and agricultural policy makers, especially in terms of encouraging fruit exports from the Republic of Serbia in the coming period.

Introduction

Promoting the concept of free trade, and emphasizing the importance of foreign trade, are present even in the early theories of international trade such as Adam Smith's theory of absolute advantage. He pointed out that a country that can produce a certain product at lower costs and higher productivity compared to other countries, has absolute advantages in production, and that such products which are the result of

1 Biljana Stankov, PhD, Lecturer at Novi Sad School of Business, Address: Vladimira Perića Valtera 4, 21000 Novi Sad, Serbia, email: milijanadjordjevic@gmail.com, ORCID ID (https://orcid.org/0000-0002-6437-4015)

2 Milijana Roganović, PhD, Lecturer at Novi Sad School of Business, Address: Vladimira Perića Valtera 4, 21000 Novi Sad, Serbia, email: milijanadjordjevic@gmail.com, ORCID ID(https://orcid.org/0000-0003-4298-3247)

3 Milan Mihajlović, PhD, Assistant Professor at Military Academy, University of Defence, Address: Veljka Lukića Kurjaka 33, 11000 Beograd, Serbia, email: milan.mih83@gmail.com, ORCID ID(https://orcid.org/0000-0001-7949-2631)

production specialization should be exported by the country. On the other hand, it is desirable to import products that could be produced in a certain country at a higher cost and lower productivity compared to other countries. Sawadogo (2019) emphasizes that differences among countries lead to the establishment of trade relations and the realization of international trade, which is mutually beneficial. At the same time, he especially emphasizes the importance of the concept of comparative advantages.

By researching the indicators of foreign trade of a country, very useful information on the state of the national economy can be obtained(Ivanova & Ristić, 2020). There is a strong connection between foreign trade and the growth of the value of gross domestic product(Jokić, 2020; Čavić & Mandarić, 2021), so the higher rates of economic growth can be achieved by those countries whose export sector is successful and competitive and which have a developed national market but also access to other markets (Balassa, 1978). In that context, Kovačević and Sabolović (2002) point out that international exchange is a consequence of the state of the national economy, trends in production and consumption, that is, supply and demand, surpluses and shortages of goods in an economic environment open to the world market.

In the past period, significant oscillations of foreign trade trends have been recorded in the Republic of Serbia, as well as a constant negative value of the foreign trade balance(Vukolić, 2020). Despite the liberalization of trade, the advantages arising from the implementation of the free trade agreements and the inclusion of the Republic of Serbia in the integration process, the value of imports is still above export values(Đurić et al., 2020). The mentioned trends are the result of low competitiveness of Serbian products on the international market (Avakumović et al., 2021), as well as the high share of primary products and products of the early stages of processing in the structure of exports.

The Republic of Serbia has developed the most intensive foreign trade relations with the countries with which it has signed free trade agreements: EU member states, signatories to the Central European Free Trade Agreement (CEFTA) and members of the European Free Trade Association (EFTA), Russia, Kazakhstan, Belarus and Turkey and the United States (Generalized System of Preferences). After the signing of the free trade agreement between Serbia and Kazakhstan, foreign trade became much more intense, but was still below its potential, with the dominance of agricultural and food exports over imports (Simić and Stankov, 2020).

The share of EU member states in the total foreign trade of our country exceeds 60%, and it is considered the most important trade partner of the Republic of Serbia. Blahović, Ilin and Umićević (2002) point out that the European Union accounted for three quarters of the total export of fruits and vegetables from our country, while Kuzman and Stegić (2015) confirm that the European Union is also the leading trade partner of the Republic of Serbia in trade in agro-industrial products. Božić and Nikolić (2016) have come to the same conclusion and state that the largest part of the value (about 50%) of agricultural exports of the Republic of Serbia is directed to the markets

of EU member states, and that member states of the European Union also have the biggest share (about 60%) in the structure of Serbian imports of agri-food products.

Fruit production is one of the most important, and certainly the most productive agricultural branches in the Republic of Serbia. Fruit growing is often considered to be the most profitable branch of the economy(Avakumović et al., 2021). Demand for fruit and fruit products shows high income elasticity, i.e. due to the growth of consumer income, there is an increase in demand for fruit, especially among middle and high income groups, both in developing and developed countries(Vukosavljević et al., 2021).

In the continuation of the paper, the authors will pay special attention to the analysis of fruit production in the Republic of Serbia, as well as the trends and specifics of foreign trade in fruit. After defining the research problem, subject, aims and hypotheses, attention will be directed on reviewing the available scientific literature and considering studies that have studied the same or similar topics. In the second part of the paper, the authors explain the applied methodology (descriptive statistical analysis and analysis of time series variations, i.e. the method of linear trend), present the obtained research results and come to relevant conclusions with emphasis on scientific and professional contribution of this study.

Materials and methods

Challenges and opportunities for fruit production and foreign trade in the Republic of Serbia

In the Republic of Serbia, there are excellent opportunities for the growth of almost all types of fruit, which is mainly due to favorable climatic conditions and soil quality, although some types of fruit can be grown on soils of more modest physical and chemical properties. Vlahović (2010) points out that a large number of fruit species are grown in the Republic of Serbia, such as apple, pear, raspberry, plum, quince, cherry, sour cherry, peach, apricot, strawberry, walnut, etc. Blagojević (2019) points out that five types of fruit (apples, plums, grapes, raspberries, sour cherries) make up about 82% of the total fruit production.

Keserović (2005) also points out to the importance of this branch of agricultural production, emphasizing that fruit growing is one of the most productive branches of agriculture, which exceeds the profitability of other branches. This is supported by Milić and Radojević (2003) who state that fruit growing, as an important area of plant production, has a number of comparative advantages over other branches of agriculture. Fruit production can reach 10 to 20 times higher value per hectare, compared to the production of important field crops, such as wheat and corn. According to the data of the Statistical Office of the Republic of Serbia in 2017, as many as 183,602 hectares of land were under orchards, of which 175,863 hectares were fertile (72,116 ha of plums, 26,360 ha of raspberries, 25,360 ha of apples, 25,281 ha of sour cherries, and 18,956 ha of other fruits).

The share of fruit in the structure of exports of agro-industrial products from the Republic of Serbia is dominant. The overall foreign trade balance of the Republic of Serbia is constantly recording a deficit, while in recent years there has been a surplus in the foreign trade of fruits. According to Vlahović (2004), the placement of fruit from the Republic of Serbia on other markets is limited not by the quality of products, but by non-compliance with strict procedures of picking, freezing, packaging, loading and transport. According to the data of the Statistical Office of the Republic of Serbia, the total value of exports of fresh and dried fruit in the period from 2004 to 2020 amounted to 2,459,776.10 USD, i.e. a total of 3,345,880 tons of fruit were exported. Apples had a dominant share in the structure of exports, followed by peaches, cranberries, blueberries, sour cherries, strawberries and plums. In the same period, 3,776,290.9 tons of fruit were imported, which amounted to 2,553,814.90 USD. The most imported types of fruit were those for the production of which there are no appropriate climatic, soil and other conditions, such as bananas, oranges, lemons and limes in the Republic of Serbia. Goldstein and Khan (1985) emphasize that economic growth strongly stimulates fruit imports and reduces inflation, while Niculae and Costaiche (2016) point out that fruit trade is very important for the development of the national economy, and that increasing fruit production has a positive effect on GDP and at the same time contributes to the reduction of imports.

Given the importance of fruit production, as well as the importance of fruit participation in foreign trade of the Republic of Serbia, the paper continues to investigate the development of exports and imports of fruits in the period from 2004 to 2020 and forecast future values using statistical methodology in the field of time series analysis.

Underlying principles of research

The research problem is related to the importance of foreign trade of fruits of the Republic of Serbia, while the subject of the research includes the analysis of previous and future trends in the value of exports and imports of fruit, as one of the most important agro-industrial products.

The aim of the research is to determine future trends and forecast future values of fruit imports and exports of the Republic of Serbia by applying econometric methodology in the field of analysis of time series variations, i.e. statistical methods of linear trend. The applied descriptive statistical analysis will also contribute to the quality of the research. The results of the conducted research will help to answer the questions: whether the researched values show a constant increase and characteristic variations that repeat over time, with an approximate straight-line tendency in accordance with the linear trend. In accordance with the previously mentioned research elements, general and specific research hypotheses are defined.

General research hypothesis:

H_0: Quantitative indicators of the trends of fruit export and import values of the Republic of Serbia in the period from 2004 to 2020 are suitable for research, since variations of the analyzed phenomenon are observed in a sufficiently long period of time.

H_a: *Quantitative indicators of the trends of fruit export and import values of the Republic of Serbia in the period from 2004 to 2020 are not suitable for research because variations of the analyzed phenomenon are not observed in a sufficiently long period of time.*

Specific research hypotheses:

$H1_{0:}$ Trends in the fruit export and import values of the Republic of Serbia in the period from 2004 to 2020 show a constant increase and characteristic variations that repeat over time and show an approximate straight-line tendency in accordance with the linear trend.

$H1_{a:}$ *Trends in the fruit export and import values of the Republic of Serbia in the period from 2004 to do not show a constant increase and characteristic variations that repeat over time and do not show an approximate straight-line tendency in accordance with the linear trend.*

$H2_{0:}$: The trend line in the case of the fruit export and import values of the Republic of Serbia is increasing, and every year in the period from 2004 to 2020 there is an average annual increase in value.

$H2_{a:}$ *The trend line in the case of the fruit export and import vales of the Republic of Serbia is declining, and every year in the period from 2004 to 2020 there is an average annual decrease in value.*

$H3_{0:}$ By applying the linear trend method, it is possible to predict future trend direction of the fruit export and import values the Republic of Serbia in the period from 2021 to 2030.

$H3_{a:}$ *By applying the linear trend method, it is not possible to predict future trend direction of the fruit export and import values of the Republic of Serbia in the period from 2021 to 2030.*

Literature review

After reviewing the available scientific and professional literature, it was noticed that a very small number of authors dealt with researching previous trends in fruit imports and exports of the Republic of Serbia and forecasting their future values using the mentioned methodology, which further increases the importance of this research study.

Khotamov and Ismoilov (2020) dealt with assessing and forecasting trends in global exports and imports of goods on the international market. They emphasize that research into the import and export trends is crucial for developing countries, and that the correct assessment and prediction of their future trends is extremely important for the growth and development of the national economy.

Matkovski, Erceg, Đokić and Kleut (2018) analyzed the production and foreign trade of berries with special emphasis on comparative advantages in exports. The authors

pointed out that the foreign trade of agricultural and food products is of special importance for the Republic of Serbia due to its high participation in trade as well as in the value of gross domestic product. They also emphasized a very important fact, that agriculture is the only economic sector of the Republic of Serbia that has a positive foreign trade balance.

Lukač-Bulatović, Vukoje and Milić (2017) investigated the most important factors that determine fruit production, with the analysis of the achieved economic results of important fruit species (apple, pear, peach, sour cherry and plum) on agricultural farms in AP Vojvodina. The authors concluded that the highest level of economic justification of production is represented in the case of pears, followed by apples, sour cherries, peaches and plums. The contribution of research is reflected in proposing measures for improving fruit production (planting quality fruit varieties, vertical connection of producers and processors and raising the level of economic security of producers).

Tomašević (2016) researched the state and possibilities of fruit production and export from the Republic of Serbia, with an emphasis on measures to increase them at the macroeconomic and microeconomic level. The author pointed out that fruit production in the Republic of Serbia has an increasing trend, and that fruit has a dominant share in the structure of exports of agricultural and food products. The value of exports of fresh fruits and processed products is conditioned by the volume and structure of domestic production and the degree of adjustment to international market demand. The author notes that in the Republic of Serbia there is no single strategy for fruit exports, that export incentives are insufficient, and that exports, among other things, can be increased by applying an appropriate marketing strategy.

Stegić (2016) identified the analysis of foreign trade of agro-industrial products between the Republic of Serbia and the European Union in the period from 2004 to 2014 as the main goal of his research in order to notice changes in trade relations, conditioned by signing the Stabilization and Association Agreement. The author stated that the primary agricultural products dominate in exports, while the structure of imports includes products of the late stages of processing, but he also notes that fruit appears as a key export and import product in trade with the European Union.

Vlahović and Puškarić (2015) investigated the export of agro-industrial products from the Republic of Serbia to the market of the Russian Federation, given that it was one of the world's largest food importers in the study period. The authors pointed out that it is necessary to increase the share of products of the late stages of processing at the expense of raw materials in the structure of exports, which would condition the optimal use of the capacity of the domestic processing industry and increase export profitability. They also suggest that the engagement of agricultural policy makers should be intensified and that the agricultural producers should be stimulated to form associations in order to increase export quantities, the quality of agricultural products and ensure continuous delivery.

In their next study, Vlahović, Puškarić and Veličković (2015) investigated the trends of apple exports and the foreign trade balance of the Republic of Serbia. The authors

stated that the apple is the leading fruit species in the structure of exports, and that intensifying the export of apples can create a good basis for increasing the total domestic fruit production. The results of the research indicate that apple production tends to grow moderately per year (4.75%), while imports were subject to oscillations due to a number of factors (producer disorganization, lack of working capital, fragmentation of production, etc.), but that in the observed period nevertheless, a positive balance of foreign trade in apples was achieved. However, despite these limitations, several larger, modernly designed plantation complexes have been built in Serbia since 2000, in which current technological solutions for growing new, more yielding apple varieties has been applied (Jeločnik, Ivanović, Subić, 2011).

In their previous studies, Vlahović, Tomić and Kuzman (2011) dealt with the investigating trends of foreign trade of agro-industrial products of the Republic of Serbia with the Republic of Croatia under the CEFTA agreement, and considering the range of opportunities for improving and expanding trade among countries. Based on the results of the research, the authors concluded that the Republic of Serbia must improve its agricultural policy by introducing strategic changes, ensure more favorable procurement of agricultural machinery and equipment for processing agri-food products, and increase the competitiveness of agro-industrial products, especially in foreign markets.

Kuzman, Ivić and Dumonjić (2011) dealt with the same research problem and concluded that the Republic of Serbia recorded a deficit in foreign trade of agro-industrial products with the Republic of Croatia, during the entire observation period. The authors suggested that the trade deficit could be eliminated by improving product quality, improving packaging, applying a marketing concept, and improving production technology.

Drašković, Stošić and Rajković (2011) investigated the production potential and trends in fruit exports of the Republic of Serbia, as a contributing factor in rural development. The authors emphasize the importance of raspberry production as a traditional export product of the Republic of Serbia, but also conclude that there are not enough incentives in this sector, and that the provisions of agricultural policy, which regulate this area, are not clearly defined. It is emphasized that the mentioned shortcomings primarily affect large fluctuations in export prices.

Vlahović, Maksimović and Puškarić (2011) studied the factors that limit the export of fruit from the Republic of Serbia and concluded that the main obstacles to promoting exports of Serbian fruit and fruit products are inadequate quality of fruit varieties and planting material, insufficient knowledge of foreign markets, lack of knowledge about new production technologies, as well as the lack of export associations that would be in charge of establishing stable and long-term relationships with importers. The authors concluded that the strategic goals of the Republic of Serbia should include high-quality production of fresh fruit and increased competitiveness on the international market.

Maksimović (2009) also researched the apple market in the world and in the Republic of Serbia. The author noted that apple producers in Serbia must increase competitiveness at the national and international level, and that it is necessary to intensify production

and apply an integrated concept, introduce modern apple varieties, apply innovative ways of storing products and use modern packaging. In this research, the importance of stable business conditions that would affect the improvement of existing export potentials was especially emphasized.

Research methodology

According to Šošić (2006), a time series is a set of chronologically arranged values of a variable, which represents the phenomenon or a statistical process in time. Depending on the character of the factors that affect a certain phenomenon over time, Horvat and Mijoč (2012) state that the time series consists of several components: trend component, seasonal, cyclical and random (irregular) component. The time series is equal to the product of all the listed components, but it is not necessary for it to contain them all. The trend component is a value that is expressed by a mathematical function and shows the developmental tendency of the phenomenon depending on time. Levine, Stephan, Krenhbiel and Berenson (2009) point out that the trend is a general, long-term upward or downward movement in time series. What is important for the trend is the ability to predict future movements of the phenomenon or feature (Horvat, Mijoč, 2012), i.e. when certain movements are analyzed through the trend, the goal is to discover the laws of development of the phenomenon, and based on that predict its future trend.

Serdar and Šošić (1992) note that if the investigated phenomenon exhibits, in the same time periods, approximately the same absolute change, i.e. decrease or increase, it is considered that its movement is approximately linear and can be expressed by a linear model. In addition to this model showing the linear movement of the time series, Biljan-August, Pivac and Štambuk (2009) also emphasize the possibility of predicting the value of the phenomenon for some future periods.

The linear trend method is very suitable for application in situations when we investigate long-term time series with one-year time periods, which is exactly the case in this study which examines trends in imports and exports of fruits of the Republic of Serbia, annually in the period from 2004 to 2020.

The general form of the linear trend function is:

$$\hat{\mathbf{Y}}\mathbf{t} = a + bx \qquad (1)$$

The time variable x is an independent variable, while the trend value $\hat{Y}$ is a dependent variable in the research. The parameter a represents the value of the function at the origin, and the parameter b is an indicator of the direction of the trend. Serdar (1997) points out that it depends on the sign that this parameter carries whether a continuous increase or decrease in the value of the investigated phenomenon is shown.

The least squares method is one of the methods by which the linear trend equation can be determined, which will be applied in this research. The advantage of its application is that it provides a trend line that is best adapted to the actual data of the time series (Hadživuković, 1989; Pantić et al., 2022).

Since the linear trend describes the development of the phenomenon in terms of average, it is necessary to determine its representativeness, that is, to provide an answer to the question of whether the model explains the movement of the dependent variable Y through time X, and to what extent it explains it. The coefficient of determination is an indicator of the representativeness of a trend model based on analysis of variance. Kovačić (2008) states that the coefficient of determination is defined as the ratio of the total sum of squares of deviations interpreted by the trend model and the total sum of squares of all deviations of the values of the time series Y variable from the arithmetic mean. The formula for calculating the coefficient of determination is:

$$R^2 = \frac{SP}{ST} \qquad (2)$$

The representativeness of the trend model is better when its value is closer to 1, as well as when there are small differences between the original values of the time series and the trend value.

Before applying the described method, a descriptive statistical analysis was performed and the following indicators of fruit exports and imports of the Republic of Serbia were calculated and interpreted: arithmetic mean, minimum, maximum and total values of observed phenomena, median, lower and upper quartile, range of variation, mean absolute deviation, standard deviation and coefficient of variation.

Research results and discussion

Descriptive statistical analysis

In the process of collecting research data, the *desk method* was applied and the secondary data source, i.e. the database of the Statistical Office of the Republic of Serbia, was used. Quantitative data on trends in exports and imports of products belonging to product group 057 - Fruit, fresh or dried (according to the standard international trade classification), in the period from 2004 to 2020 (observation period is 17 years), expressed in US dollars were collected (USD).

Based on the data shown in Table 1, it is concluded that the investigated phenomenon is observed in a sufficiently long period of time, to manifest, in equal time periods (one year) approximately the same absolute change, and that its movement is approximately linear and can be expressed by linear model.

The total value of fruit imports in the Republic of Serbia in the observed period amounted to 2,553,814.90 USD and was slightly higher than the total value of exports. The minimum value was realized in 2004 in the amount of 70,101.30 USD, while the maximum value of imports was realized in 2020 when it amounted to 242,541.60 USD.

The total value of fruit exports from the Republic of Serbia in the observed period amounted to 2,459,776.10 USD. The minimum value was realized in 2005 in the amount of 20,301.90 USD, while the maximum value of exports reached 2017,

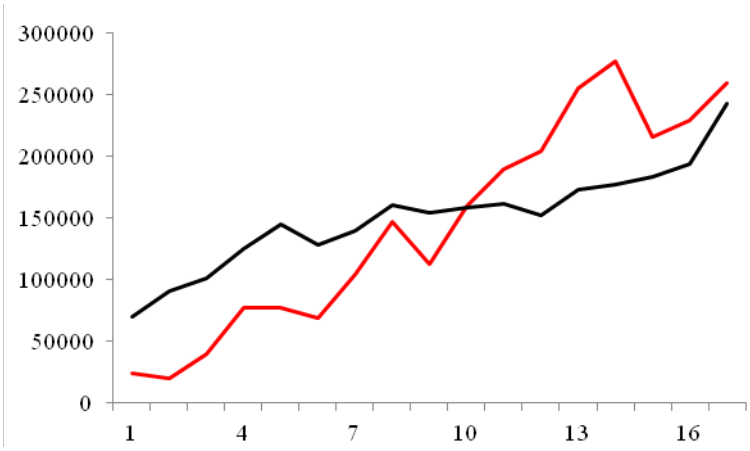
when it amounted to 276,849.50 USD. The average annual value of fruit imports was 150,224.41 USD, and the value of exports was slightly less - 144,692.7 USD.

Table 1. Quantitative trends in fruit exports and imports of the Republic of Serbia in the period from 2004 to 2020 in thousands of USD

Year	Value of exports	Value of imports	Balance	Coverage ratio (%)
2004	24050,90	70101,30	-46050,40	34
2005	20301,90	90426,70	-70124.80	22
2006	39279,80	101463,90	-62184,10	39
2007	77559,40	125004,40	-47445,00	62
2008	77627,60	145028,20	-67400,60	54
2009	68363,00	127771,80	-59408,80	54
2010	104502,30	139401,50	-34899,20	75
2011	146685,00	160001,80	-13316,80	92
2012	112336,00	153944,00	-41608,00	73
2013	159527,10	158286,10	1241,00	101
2014	189537,80	161140,60	28397,20	118
2015	203937,00	151787,90	52149,10	134
2016	255109,40	173147,80	81961,60	147
2017	276849,50	177166,60	99682,90	156
2018	215643,60	183002,70	32640,90	118
2019	228833,00	193598,00	35235,00	118
2020	*259632,80*	*242541,60*	*17091,20*	*107*

Source: Review of authors based on data from the Statistical Office of the Republic of Serbia (www.stat.gov.rs)

Figure 1. Trends in fruit imports and exports of the Republic of Serbia in the period from 2004 to 2020



Source: Review of authors based on data from the Statistical Office of the Republic of Serbia

Note: Red line is export and black line is import.

Based on the data presented in the Graph 1, it can be concluded that in the period from 2004 to 2013, fruit imports exceeded export values. The value of exports increased sharply in 2013, compared to 2012, while in the same period imports also showed growth that was much lower in intensity. From 2013 until the end of the research period, the value of fruit exports from the Republic of Serbia to other markets was higher than imports, and the coverage ratio in that period exceeded 100%.

Based on the indicators of the descriptive statistical analysis of fruit imports of the Republic of Serbia, the following can be concluded: 50% of the realized value of imports was more than 153,944.00 USD, 25% of the value less than or equal to 127,771.80 USD, while 25% of the value was greater than or equal to 173,147.80 USD. The range of variation was 172,440.30 USD, then the average absolute deviation of individual import values from the average annual value reached 29,690.95 USD, while the average deviation of individual fruit import values from the average annual value was 39,617.97 USD.

Table 2. Descriptive statistical analysis of fruit exports and imports of the Republic of Serbia in the period from 2004 to 2020

Indicator	Export	Import
Number of observation periods	17	17
Minimum	20.301,90	70.101,30
Maximum	276.849,50	242.541,60
Total	2.459.776,10	2.553.814,90
Arithmetic mean	144.692,71	150.224,41
Median	146.685,00	153.944,00
The lower quartile	77.559,40	127.771,80
The upper quartile	215.643,60	173.147,80
Range of variation	256.547,60	172.440,30
Mean absolute deviation	74.531,86	29.690,95
Standard deviation	83792,31	39.617,97
Coefficient of variation	58%	26%

Source: Review of authors based on data from the Statistical Office of the Republic of Serbia (www.stat.gov.rs)

The variability in the value of fruit imports of the Republic of Serbia in the period from 2004 to 2020 was relatively weak (26%).

Based on the indicators of descriptive statistical analysis of fruit exports of the Republic of Serbia, the following can be concluded: 50% of the realized value of exports was more than 146,685.00 USD, 25% of value was less than or equal to 77,889.40 USD, while 25% of value was greater than or equal to 215,643.60 USD. The range of variation was 256,547.60 USD, then the average absolute deviation of individual import values from the average annual value reached 74,531.86 USD, while the average deviation of individual values of fruit imports from the average annual value was 83,792.31 USD. The variability in the value of fruit imports of the Republic of Serbia in the period from 2004 to 2020 was relatively strong (58%).

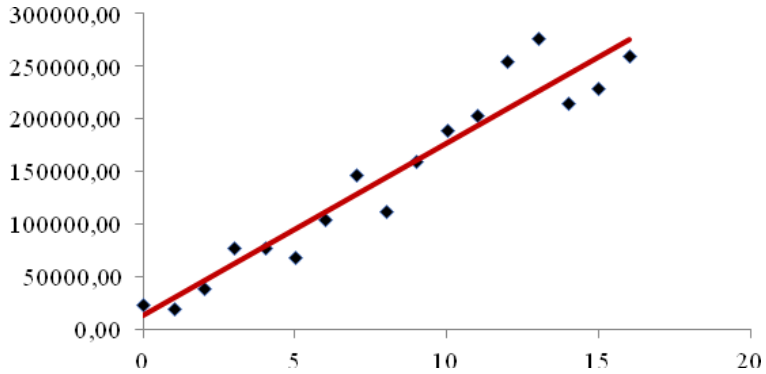
Linear trend method

The presented data indicate that the time series of data on the value of exports and imports of fruits of the Republic of Serbia shows an approximately linear movement, and therefore can be expressed by a linear model. Using the least squares method, the linear trend equation was determined, so that the starting year of the researched period, 2004, was chosen as the starting point. The unit for x (base time unit) is one year, and the unit for y (feature value) is one thousand USD. The equations of the linear trend of fruit exports and imports of the Republic of Serbia are as follows:

Export: $\hat{Y}t = 13348 + 16418x$ (3)

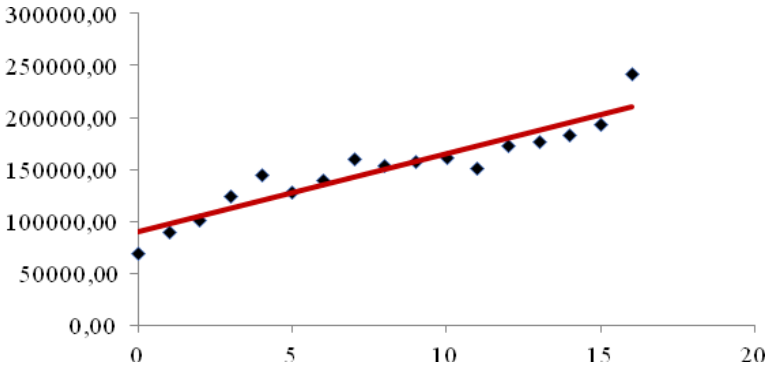
Import: $\hat{Y}t = 89870 + 7544x$ (4)

Figure 2. The linear trendline of fruit exports from the Republic of Serbia in the period from 2004 to 2020



Source: Presented by the authors based on their own calculations

Figure 3. The linear trendline of fruit imports to the Republic of Serbia in the period from 2004 to 2020



Source: Presented by the authors based on their own calculations

Based on the set equations, it is concluded that the theoretical value of the trend in the starting point is 13348 in the case of exports, and 89870 in the case of fruit imports. This value indicates the point at which the trend line intersects the coordinate axis Y in a rectangular coordinate system. We also find out how much was the theoretical, expected value of exports, that is, imports of fruits of the Republic of Serbia on January 1, 2004. In each observed year in the period from 2004 to 2020, the value of fruit exports from the Republic of Serbia to other markets increased by an average of 16,418 USD, while the value of imports increased by an average of 7,544 USD. These data also indicate that in both cases (exports and imports) the trend line is increasing.

By calculating the average annual rate of change (s = b/average y * 100) we conclude that during the research period the value of fruit exports increased by an average of 11.35% per year, while the value of fruit imports increased by an average of 5.02% per year.

Given that the linear trend model describes the development of the phenomenon in terms of average, it is necessary to determine its representativeness. By calculating the value of the coefficient of determination ($R^2 = 0.921$ for exports and $R^2 = 0.870$ for imports) it is concluded that 92.10% of changes in the value of fruit exports from the Republic of Serbia and 87% of changes in the value of fruit imports of the Republic of Serbia are explained by the presented linear trend model. The representativeness of the linear trend model is very high in both cases.

At the end of the research, the forecast of future values of exports and imports of fruits of the Republic of Serbia for the next ten-year period, i.e. until 2030, is performed. The possibility of extrapolating data is one of the most common reasons for studying a trend in the movement of a phenomenon. In this context, Hadživuković (1989) notes that extrapolation is formally performed with the assumption that the phenomenon will continue in the future as in the past, which can be concluded on the basis of presented data on trends in exports and imports of fruits of the Republic of Serbia, since for the last 17 years, no significant oscillations have been recorded, with the possibility of taking into account a certain moment that will have effect in the future, but whose effect was not present before.

Based on the research of current trends in exports and imports of fruits of the Republic of Serbia, it is predicted that in the next ten years the growth trend of export and import values will continue with the coverage of imports by exports ranging from 134% to 154%. It is predicted that, in the period from 2021 to 2030, the value of fruit exports on an annual level will exceed import values, and that a positive foreign trade balance will be achieved when it comes to fruit trade. The values of exports and imports of fruits of the Republic of Serbia will continue to grow in the coming period, with the growth rate of exports being higher than the growth rate of imports.

Observing the last year of extrapolated values, it is concluded that the value of fruit exports from the Republic of Serbia to foreign markets will be 1.7 times higher, i.e. that the value of fruit imports will be 1.18 times higher than the values achieved ten years ago (during 2020).

Table 3. Overview of previous trends and projected values of fruit exports and imports of the Republic of Serbia in the period from 2021 to 2030 using the linear trend method

Year	(Xti)	Export (Yti)	Year	(Xtu)	Import (Ytu)	Balance	Coverage ratio (%)
2004	0	24050,90	2004	0	70101,30	-46050,40	34
2005	1	20301,90	2005	1	90426,70	-70124.80	22
2006	2	39279,80	2006	2	101463,90	-62184,10	39
2007	3	77559,40	2007	3	125004,40	-47445,00	62
2008	4	77627,60	2008	4	145028,20	-67400,60	54
2009	5	68363,00	2009	5	127771,80	-59408,80	54
2010	6	104502,30	2010	6	139401,50	-34899,20	75
2011	7	146685,00	2011	7	160001,80	-13316,80	92
2012	8	112336,00	2012	8	153944,00	-41608,00	73
2013	9	159527,10	2013	9	158286,10	1241,00	101
2014	10	189537,80	2014	10	161140,60	28397,20	118
2015	11	203937,00	2015	11	151787,90	52149,10	134
2016	12	255109,40	2016	12	173147,80	81961,60	147
2017	13	276849,50	2017	13	177166,60	99682,90	156
2018	14	215643,60	2018	14	183002,70	32640,90	118
2019	15	228833,00	2019	15	193598,00	35235,00	118
2020	16	259632,80	2020	16	242541,60	17091,20	107
2021	17	292455,25	2021	17	218122,67	74332,58	134
2022	18	308873,31	2022	18	225666,92	83206,41	137
2023	19	325291,37	2023	19	233211,17	92080,20	139
2024	20	341709,43	2024	20	240755,42	100954,01	142
2025	21	358127,49	2025	21	248299,67	109827,82	144
2026	22	374545,55	2026	22	255843,92	118701,63	146
2027	23	390963,61	2027	23	263388,17	127575,44	148
2028	24	407381,67	2028	24	270932,43	136449,24	150
2029	25	423799,73	2029	25	278476,68	145323,05	152
2030	26	440217,79	2030	26	286020,93	154196,86	154

Source: Review of authors based on data from the Statistical Office of the Republic of Serbia (www.stat.gov.rs)

Conclusion

By applying a set of methodological procedures specific for the analysis of time series variations, the truthfulness of defined hypotheses, general and specific, was tested. The results of the descriptive statistical analysis provided valuable insights into the value of exports and imports of fruits of the Republic of Serbia in the period up to 2020. The obtained research results, which were obtained by applying the analysis of the time series variations, indicated the acceptance of null, and the rejection of the alternative hypothesis, in the case of the general hypothesis and all groups of specific hypotheses, which contributed to relevant and impartial research conclusions. Therefore, with the high representativeness of both models of the linear trend, the authors state the following:

- Quantitative indicators of trends in the value of exports and imports of fruits of the Republic of Serbia in the period from 2004 to 2020 are suitable for research as variations of the analyzed phenomenon are observed over a sufficiently long period of time.
- The mentioned trends show a constant increase and characteristic variations that are repeated over time and show an approximate straight-line tendency in accordance with the linear trend.
- The trend line of the value of exports and imports of fruits of the Republic of Serbia is increasing, and every year in the period from 2004 to 2020 there was an average annual increase in both values.
- By applying the linear trend method, the future trend direction the fruit export and import values of the Republic of Serbia in the period from 2021 to 2030 is predicted.

It is concluded that the trend of growth in the value of exports and imports of fruits of the Republic of Serbia will continue in the future, with more intensive growth in the value of exports compared to imports. Also, due to the coverage of imports by exports, it is expected that trade in fruit will cause a surplus in the foreign trade balance of the Republic of Serbia, at least when it comes to this type of agro-industrial products. The contribution of this research study is multiple, in the scientific sense it expands the scope of existing scientific literature, given that research studies that have addressed this issue are very rare, while in practical terms it provides guidance to producers and exporters of fruits and agricultural policy makers. especially in terms of encouraging fruit exports from the Republic of Serbia in the coming period.

Conflict of interests

The authors declare no conflict of interest.

References

1. Avakumović, J., Tešić, R., & Karić, D. (2021). Management of transition processes in the function of sustainable development. *Održivi razvoj*, *3*(1), 7-16. https://doi.org/10.5937/OdrRaz2101007A
2. Avakumović, J., Marjanović, N., & Rajković, A. (2021). Capital cost management for the purpose of making investment decisions. *Akcionarstvo,* 27(1), 89-106[in Serbian: Avakumović, J., Marjanović, N., & Rajković, A. (2021). Menadžment cene kapitala u svrhu donošenja investicionih odluka].
3. Balassa, B. (1978). Exports and economic growth: further evidence. *Journal of development Economics, 5*(2), 181-189.
4. Biljan-August M., Pivac, S., & Štambu, A. (2009). *Uporaba statistike u ekonomiji.* Rijeka: Ekonomski fakultet Sveučilišta u Rijeci.

5. Blagojević, M. (2019). Needs analysis for the construction of a warehouse for fruits and vegetables in the Republic of Serbia. *Proceedings of the Faculty of Technical Sciences in Novi Sad*, 34(09), 1678-1681. [in Serbian: Blagojević, M. (2019). Analiza potreba za izgradnjom skladišta za voće i povrće u Republici Srbiji].
6. Božić, D., & Nikolić, M. (2016). Characteristics of foreign trade of agricultural and food products of Serbia. *Marketing, 47*(4), 293-304. [in Serbian: Božić, D., & Nikolić, M. (2016). Obeležja spoljnotrgovinske razmene poljoprivredno-prehrambenih proizvoda Srbije].
7. Čavić, S., & Mandarić, M. (2021). Authenticity of gastronomic events as a function of branding a destination. *Menadžment u hotelijerstvu i turizmu, 9*(1), 89-101. https://doi.org/10.5937/menhottur2101089C
8. Đurić, K., Prodanović, R., Čavlin, M., & Lukač-Bulatović, M. (2020). Economic performance of agroindustry in AP Vojvodina. *Oditor*, *6*(2), 7-19. https://doi.org/10.5937/Oditor2002007D
9. Drašković, B., Stošić, I., & Rajković, Z. (2011). Fruit production and export as a factor of rural development. *Ekonomika poljoprivrede, 58*(1), 72-80.
10. Goldstein, M., & Khan, M. S. (1985). Income and price effects in foreign trade. *Handbook of international economics, 2*, 1041-1105.
11. Hadživuković, S. (1989). Statistics - Third Revised Edition Beograd: Privredni pregled Beograd. [in Serbian: Hadživuković, S. (1989). *Statistika - Treće dopunjeno izdanje*.].
12. Horvat, J., & Mijoč, J. (2012). Basics of statistics. Zagreb: Naklada Ljevak d.o.o., Zagreb. . [in Serbian: Horvat, J., & Mijoč, J. (2012). *Osnove statistike*.].
13. Ivanova, B., & Ristić, S. (2020). Accumulation and concentration of capital. *Akcionarstvo*, 26(1), 26-34[in Serbian: Ivanova, B., & Ristić, S. (2020). Akumulacija i koncentracija kapitala].
14. Jeločnik, M., Ivanović, L., & Subić, J. (2011). Analysis of coverage of variable costs in apple production. *Škola biznisa, 4*(2), 42-49. [in Serbian: Jeločnik, M., Ivanović, L., & Subić, J. (2011). Analiza pokrića varijabilnih troškova u proizvodnji jabuke].
15. Jokić, M. (2020). The importance of considering internal audit as a decision-making by top-management of an agricultural company. *Oditor*, *6*(3), 123-136. https://doi.org/10.5937/Oditor2003123J
16. Keserović, Z. (2004). Modern tendencies in apple and pear production. Novi Sad: Zadružni savez Vojvodine. [in Serbian: Keserović, Z. (2004). *Savremene tendencije u proizvodnji jabuke i kruške*].
17. Khotamov, I., & Ismoilov, A. (2020). Is estimating and forecasting trends of global export and import of goods in international markets. *Архив научных исследований.*
18. Kovačević, B., & Sabolović, D. (2002). Stanje i razvojne tendencije vanjskotrgovinske razmjene Republike Hrvatske. *Ekonomija, 2*(9), 293-316.

19. Kuzman, B., Ivić, M., & Dumonjić, B. (2011). Foreign trade of agro-industrial products of the Republic of Serbia and the Republic of Croatia. In: Multifunctional agriculture and rural development in the function of the Republic of Serbia's accession to the European Union (pp. 292-304). Beograd: Ministarstvo za nauku i tehnološki razvoj Republike Srbije. [in Serbian: Kuzman, B., Ivić, M., & Dumonjić, B. (2011). Spoljno trgovinska razmena agroindustrijskih proizvoda Republike Srbije i Republike Hrvatske. U: *Multifunkcionalna poljoprivreda i ruralni razvoj u funkciji uključenja Republike Srbije u Evropsku uniju*].
20. Kuzman, B., & Stegić, M. (2015). Agro-food trade between Serbia and EU with focus on countries of Danube region. In *Sustainable agriculture and rural development in terms of Republic of Serbia strategic goals realization within the Danube region* (pp. 330-346). Belgrade: The Institute of Agricultural Economics.
21. Levine, D. M., & Stephan, D. F. (2009). *Even you can learn statistics: A guide for everyone who has ever been afraid of statistics*. FT Press.
22. Lukač-Bulatović, M., Vukoje, V., & Milić, D. (2017). Economic indicators of production of important fruit species in Vojvodina. *Ekonomika poljoprivrede, 64*(3), 973-985. [in Serbian: Lukač-Bulatović, M., Vukoje, V., & Milić, D. (2017). Ekonomski indikatori proizvodnje važnijih voćnih vrsta u Vojvodini].
23. Maksimović, B. (2009). Apple market in the world and the Republic of Serbia. Beograd: Institut za ekonomiku poljoprivrede Beograd. [in Serbian: Maksimović, B. (2009). *Tržište jabuku u svetu i Republici Srbiji*].
24. Matkovski, B., Erceg, V., Đokić, D., & Kleut, Ž. (2018). Potentials of berry fruit export from Serbia. *Agroekonomika, 47*(78), 13-21. [in Serbian: Matkovski, B., Erceg, V., Đokić, D., & Kleut, Ž. (2018). Potencijali izvoza jagodastog voća iz Srbije].
25. Milić, D., & Radojević, V. (2003). Production-economic and use value of fruits and grapes. Novi Sad: Poljoprivredni fakultet. [in Serbian: Milić, D., & Radojević, V. (2003). *Proizvodno-ekonomska i upotrebna vrednost voća i grožđa*].
26. Niculae, I., & Costaiche, G. M. (2016). Study on the influence of import and export of fruit in Romania on economic indicators. *Scientific Papers: Management, Economic Engineering in Agriculture & Rural Development, 16*(1).
27. Republički zavod za statistiku Republike Srbije, www.stat.gov.rs
28. Pantić, N., Mikulič, K., & Lekovič, M. (2022). The influence of claims payments on the investment portfolio of insurance companies. Oditor, 8(3), 42-71. https://doi.org/10.5937/Oditor2203042P
29. Sawadogo, R. (2019). Insurance development and international trade in developing countries. *The International Trade Journal, 33*(3), 239-254.
30. Serdar,V. (1997).*Udžbenik statistike*. Zagreb: Školska knjiga.
31. Serdar, V., & Šošić, I. (1992). *Uvod u statistiku*. Zagreb: Školska knjiga.
32. Simić, M., & Stankov, B. (2020). Foreign trade in agricultural products between the Republic of Serbia and the Republic of Kazakhstan – A decade since the singing of the free trade agreement. *School of Business, 17*(1), 86-111.

33. Šošić, I. (2006). *Primijenjena statistika.* Zagreb: Školska knjiga.
34. Stegić, M. (2016). Foreign trade of agro-industrial products between Serbia and the European Union. *Ekonomija – teorija i praksa, 9*(1), 1-13. [in Serbian: Stegić, M. (2016). Spoljnotrgovinska razmena agroindustrijskih proizvoda između Srbije i Evropske unije].
35. Tomašević, D. (2016). Status and possibilities of fruit production and export from Serbia. Čačak: Agronomski fakultet u Čačku. [in Serbian: Tomašević, D. (2016). *Stanje i mogućnosti proizvodnje i izvoza voća iz Srbije*].
36. Vlahović, B. (2004). *Market of agro-industrial products*. Novi Sad: Poljoprivredni fakultet u Novom Sadu. [in Serbian: Vlahović, B. (2004). *Tržište agroindustrijskih proizvoda*].
37. Vlahović, B. (2010). *Market of agro-industrial products*. Novi Sad: Poljoprivredni fakultet u Novom Sadu. [in Serbian: Vlahović, B. (2010). *Tržište agroindustrijskih proizvoda*].
38. Vlahović, B., & Puškarić, A. (2015). Status and perspectives of exports of agro-industrial products of the Republic of Serbia to the market of the Russian Federation. *Agroekonomika, 44(*66), 13-25. [in Serbian: Vlahović, B., & Puškarić, A. (2015). Stanje i perspektiva izvoza agroindustrijskih proizvoda Republike Srbije na tržište Ruske Federacije]
39. Vlahović, B., Ilin, Z., & Umićević, B. (2002). Present situation and perspectives of joining the international vegetable market. *Savremeni povrtar* (Serbia and Montenegro).
40. Vlahović, B., Maksimović, B., & and Puškarić, A. (2011). Limiting Factors of Fruit Export of the Republic of Serbia. *Petroleum-Gas University of Ploiesti Bulletin, Economic Sciences Series, 63*(4).
41. Vlahović, B., Puškarić, A., & Veličković, S. (2015). Export of apples from the Republic of Serbia: Status and tendencies. *Agroekonomika: časopis Instituta za ekonomiku poljoprivrede i sociologiju sela, 44*(65), 10-21. [in Serbian: Vlahović, B., Puškarić, A., & Veličković, S. (2015). Izvoz jabuke iz Republike Srbije: Stanje i tendencije]
42. Vlahović, B., Tomić, D., & Kuzman, B. (2011). Foreign trade of agro-industrial products of the Republic of Serbia and Croatia. *Tranzicija, 13*(27), 120-127. [in Serbian: Vlahović, B., Tomić, D., & Kuzman, B. (2011). Spoljnotrgovinska razmena agroindustrijskih proizvoda Republike Srbije i Hrvatske]
43. Vukolić, D. (2020). Gastronomic product in the function of development of different forms of tourism in Srem district. *Održivi razvoj*, *2*(2), 41-54. https://doi.org/10.5937/OdrRaz2002041V
44. Vukosavljević, D., Kaputo, J., Tešić, A., & Vukosavljević, D. (2021). Macroeconomic environment and the public sector: Place and role. *Oditor*, *7*(3), 37-50. https://doi.org/10.5937/Oditor2103037V

UNDERSTANDING FARMERS' BAHAVIOUR REGARDING PESTICIDE USE IN VOJVODINA REGION

Jelena Despotović[1], Vesna Rodić[2], Danica Bošnjak[3], Vesna Miltojević [4]

**Corresponding author E-mail: rodicv@polj.uns.ac.rs*

ARTICLE INFO

Original Article

Received: *30 June 2022*

Accepted: *15 August 2022*

doi:10.59267/ekoPolj230147D

UDC 631-051:632.95(497.11)

Keywords:

pesticides, use, environment, farmers, behaviour, Vojvodina

***JEL**: D01, D91, O13, Q12*

ABSTRACT

Requirements to provide high and stable yields and high-quality agricultural products at reasonable prices are hard to meet without any use of pesticides. However, in addition to significant positive effect their application often has adverse effects on human health and environment. This study aims to uncover crop farmers' behaviour regarding pesticide use in Serbia's region of Vojvodina. The research was conducted based on farmers' self-assessment regarding the application of pesticides. The results show that farmers have a serious and responsible approach concerning certain aspects of pesticide use. They generally follow recommendations, particularly concerning the pre-harvest interval, as well as the washing and maintenance of equipment. However, they often neglect other aspects, especially those related to their own safety protection. The study concludes that the mechanisms of appropriate sharing of information and farmers' education should be addressed by decision-makers and that the advisory service should play a strong role in this process.

Introduction

Historically, harvest was the part of agricultural production that was not affected by diseases, pests, and weeds (Roettele et al., 2018). With the development of agriculture, farmers

1 Jelena Despotović, PhD, assistant professor, University of Novi Sad, Faculty of Agriculture, Department of Agricultural Economics and Sociology, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia, Phone: +381214853331, E-mail: jelenak@polj.uns.ac.rs, ORCID ID (https://orcid.org/0000-0002-9720-4805)

2 Vesna Rodić, PhD, full-time professor, University of Novi Sad, Faculty of Agriculture, Department of Agricultural Economics and Sociology, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia, Phone: +381214853313, E-mail: rodicv@polj.uns.ac.rs, ORCID ID (https://orcid.org/0000-0003-4405-7933)

3 Danica Bošnjak, PhD, retired full-time professor, University of Novi Sad, Faculty of Agriculture, Department of Agricultural Economics and Sociology, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia, E-mail: danicab@polj.uns.ac.rs

4 Vesna Miltojević, PhD, full-time professor, University of Niš, Faculty of Occupational Safety, 10a Čarnojevića Street, 18000 Niš, Serbia, Phone: +38118529769, E-mail: vesna.miltojevic@znrfak.ni.ac.rs, ORCID ID (https://orcid.org/0000-0003-0706-1634)

have increasingly protected cultivated crops, seeking to preserve as much of their yield as possible. Today, crop protection is one of the most important activities which aims to reduce the dependence of production results on the harmful effects of weeds, diseases, and pests (Aktar et al., 2009). Crop protection will continue to be one of the key issues in agricultural production, which is strongly suggested by projected world population growth (UN, 2019), its resulting growth in food demand (EU, 2019), climate change with the potential to reduce yields (FAO, 2019), and the degradation of arable land (Prăvălie et al., 2021).

The methods of plant protection have changed over time, but today, in most cases, plant protection is carried out using chemical agents generally known as pesticides (Đokić et al., 2018). The worldwide consumption of pesticides is constantly on the increase and this trend is expected to continue in the future (Sharma et al., 2019). However, recent studies show that changes in the management of pesticides could reduce the global consumption of synthetic pesticides by as much as 42% without any serious negative impact on farm productivity and profitability (Lechenet et al., 2017).

Unfortunately, the application of pesticides does not produce only significant positive effects (Cooper, Dobson, 2007), but also numerous negative externalities (Damalas, 2009). Its main adverse effects are exerted on the health and safety of farmers applying pesticides and non-targeted living beings in the ecosystem. It also causes water, air and soil pollution, and poses many health risks for the consumers who eat food with pesticide residues (Syed et al., 2014).

A wrong choice or improper use of pesticides has both economic and ecological implications (Houbraken et al., 2016). Many negative consequences are unintentional, but that does not reduce the damage. According to Ozkan, the unintended consequences of pesticide application are most often caused by their inappropriate use, which occurs primarily due to their users' lack of knowledge and information (Ozkan, 2009).

One of the unintended consequences of pesticide application is the impact on the person who applies them. To avoid such consequences, personal protection is essential, i.e., wearing a mask, long sleeves, trousers, closed footwear, hats, and gloves; adequate cleaning of clothes and frequent handwashing with soap are also crucial (Salvatore et al., 2008; Furlong et al, 2015). The use of pesticides without protective equipment can cause health problems such as headaches, skin irritation, eye irritation, fatigue, muscle aches, cough, sneezing, excessive sweating, dizziness, nausea, abdominal pain, and vomiting (Houbraken et al., 2016; Bhandari et al., 2018). Hazardous practices include mixing pesticides with bare hands, spraying with brushes or twigs, and testing the concentration of pesticide solution by licking it (Dinham, 2003; Macharia et al., 2013). Nicol has proven that not only farmers who handle pesticides are exposed to health risks, but often their family members are at risk too (Nicol, 2003). It is also important to note that pesticide residues can cause nutrient imbalances and reduce the quality of agricultural products (Bourn, Prescott, 2002; Hou, Wu, 2010).

Apart from providing substantial benefits for agriculture, pesticides may also pose a major threat to all living organisms in an agroecosystem if applied improperly (Timprasert et

al., 2014; Houbraken et al., 2016). Although the purpose of pesticide application is to prevent crop diseases and destroy weeds and pests that endanger yields and the quality of crops, many untargeted plant and animal species, including beneficial predators of pests, are often injured or killed (Roca, 2011). It is well documented that exposure to pesticides has adverse effects on plants (John and Shaike, 2015), vertebrates (Zala, Penn, 2004), birds (Giesy et al., 2003; Iwaniuk et al., 2006), soil microorganisms (Adesodun et al., 2005), fish and other aquatic organisms (Oruç, 2010; Grung et al., 2015).

There are different techniques for the application of pesticides. The roughest division is into manual and mechanized application, the latter of which can be done from the ground (trucks, tractors with sprayers, self-propelled sprayers) or the air (spraying from airplanes) (Carvalho, 2017). Regardless of the method used, pesticide application can cause pollution of air, soil, and water. Pollution can occur from point or non-point sources (Vischetti et al., 2007). Point sources include pollution resulting from activities such as tank filling, washing, and disposal of packaging waste, or from spills and leaks caused by faulty equipment (Carter, 2000). Non-point sources of pollution refer to the application of pesticides through various mechanisms such as spraying, swelling, and rinsing (Screpanti et al., 2005).

An additional health and environmental risk can be posed by pesticide packaging waste if it is improperly discarded (Mello, Scapini, 2016). Leaking pesticide residues from discarded packaging contaminate soil, surface water and groundwater, and can endanger living organisms if they come into contact with it (Patarasiriwong et al., 2013). Therefore, before disposal, it is necessary to prepare pesticide packaging waste for further safe handling. In 2008, the Food and Agriculture Organization and the World Health Organization created a guide to handling pesticide packaging waste (FAO and WHO, 2008). According to FAO and WHO, the method of triple rinsing of pesticides packaging waste before its disposal, proved to be safe. Rinsing should be performed immediately after emptying the packaging. The washed contents should be returned to the sprayer and used on crops (FAO and WHO, 2008). This enables not only the use of the entire contents of the package but also prevents spot contamination.

Burning and burying pesticide packaging waste is considered a highly undesirable practice that should be prohibited since hazardous components are not destroyed in this way, but are emitted into the environment (FAO and WHO, 2008). The Guide recommends different waste disposal solutions such as reversible distribution (returning emptied packaging to dealers), specialized pesticide packaging waste collection centres, and recycling centres (FAO and WHO, 2008). However, for all these waste disposal options to be suitable, certain preconditions have to be fulfilled: infrastructure construction; regulated legislation; active involvement of all stakeholders in the supply chain; developed information mechanism; and social, environmental, and economic acceptance by a specific local community (Patarasiriwong et al., 2013).

Proper handling of pesticides is crucial for the reduction of environmental and health risks. The expertise of those who handle pesticides is highly important for the

implementation of an adequate strategy to reduce the negative impact of pesticides on human health and the environment (Kien, 2015; Houbraken et al., 2016). On the other hand, it is difficult to monitor how the actual farmers act in the field. Sapbamrer and Thammachai (2020) in their systematic review on pesticide safety practices concluded that the information describing pesticide safety practices appears fairly limited and inconsistent. Therefore, this paper aims to uncover behaviour regarding pesticide use (selection of pesticides, following dosage instructions, application timing, frequency of application, weather conditions, pre-harvest interval, and management of packaging waste) among crop farmers in Vojvodina. The research hypothesis is that undesirable practices among farmers regarding the use of pesticides exist, with consequences for the environment and the health of farmers. The research was conducted based on farmers' self-assessment regarding the application of pesticides.

The remainder of the paper is organized as follows: in the next section, the study area is shortly described and the methodology of collecting empirical data and its analysis are explained; after that, research findings are presented and discussed; and finally, conclusions are drawn, recommendations are given to decision-makers, and research limitations are explained and followed by recommendations for future research.

Materials and methods

To achieve the goal of the research, a survey of 400 farmers from the northern Serbian province Vojvodina was conducted. Due to its sustainable share in total employment and foreign trade exchange, agriculture represents an important sector of Serbian economy and Vojvodina was selected for the study because its agriculture is the backbone of the region's development. Favourable natural conditions for agricultural production (in terms of soil, climate, and hydrology) make Vojvodina the most intensive agricultural area in the country (Despotović et al., 2019). According to the latest Census of Agriculture (SORS, 2012), the province has around 2 million hectares of available land, which is 38 percent of the total available land in the country (without Kosovo and Metohija). However, the province share in the total national utilized agricultural area is 46.81%, while the share in the total arable land is 58.34 percent. An additional reason for the selection of Vojvodina as the study area is the fact that the use of synthetic pesticides is more spread among farmers in this region than in the rest of the country. According to Karapandžin and Rodić (2017), 83.78% of agricultural land in Vojvodina is treated with pesticides, which is significantly higher than the average in the country (61.30%). Hence, understanding pesticide use behaviour among farmers in this region is crucial for the promotion of a shift towards more sustainable agricultural practices.

The sample contains different municipalities, in proportion to their participation in the total number of registered farms larger than 10 ha in the province (SORS, 2012). The survey was conducted from April 2017 to January 2018. The selection of farmers within each municipality is random, and their participation is voluntary and anonymous. According to the Code of Academic Integrity of the University of Novi Sad (adopted

on January 30, 2020) which defines the conditions of scientific research work with respondents, for voluntary and anonymous research it is not necessary to obtain a special permit.

The survey questionnaire consists of several parts and is rather complex and extensive (Karapandžin, 2019). For this paper, only a part of the collected data related to pesticide handling was used. Of the total number of surveyed agricultural producers, 15 did not provide answers to all questions of interest for this research. Therefore, they were excluded from further analysis, so the final sample covered 385 subjects. Descriptive statistical methods were used to process the collected data.

Results and Discussion

Basic characteristics of the surveyed farmers and farms are shown in *Table 1*. The data show that the sample is dominated by male farmers with a high school diploma whose only source of income is agriculture. The respondents' average age is 41.59, with an average of 20.95 years of experience in agriculture. Only 34% of the surveyed farmers have a matching education, i.e., some kind of degree in the field of agriculture (*Table 1*). The average farm size is 51.89 ha. A substantial deviation from the average values shows that the sample is heterogeneous regarding the farm size. A smaller number of farms are engaged exclusively in field crop production (40.3%), while other farms carry out mixed field crops and livestock production (*Table 1*). The surveyed population's cooperation with the extension service is at a relatively low level as only 57.4% of the respondents have reported frequent cooperation with it (several times a year).

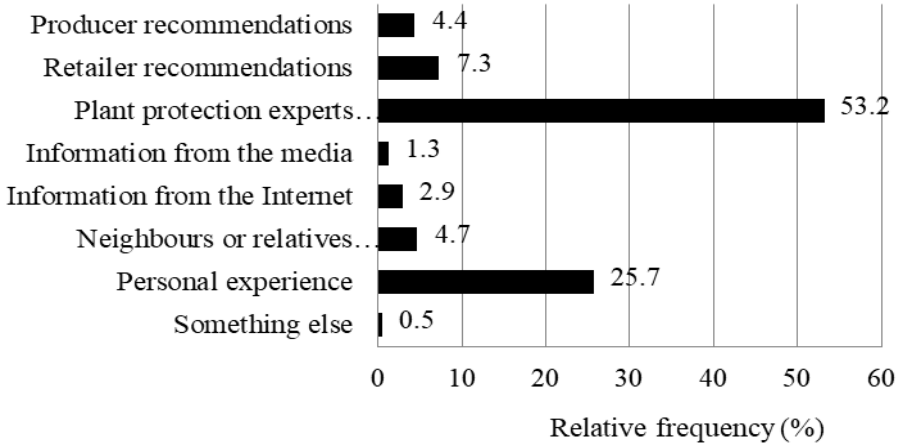
Table 1. Basic characteristics of surveyed farmers and their farms.

Variables	Min-Max/Relative Frequency %	Mean	SD
Gender	female (=0) =2.1 male (=1) =97.9	0.97	n.a.*
Age	20-82	41.59	12.64
Education	elementary (=0) 11.2 secondary (=1) 73.0 tertiary (=2) 15.8	1.05	0.52
Experience in agriculture	2-64	20.95	11.52
Formal education in agriculture	no (=0) =66.0 yes (=1) =34.0	0.34	n.a.
Farm size	10-200 ha	51.89	40.63
Livestock production	no (=0) =40.3 yes (=1) =59.7	0.59	n.a.
Contact with extension service	rarely or never (=0) = 42.6	0.57	n.a.
	frequently (=1)= 57.4		
*n.a. – not applicable			

Source: Authors calculations

The survey results show that the majority of respondents (53.2%) make responsible decisions on the type of pesticides to be applied; i.e., their selection is predominantly based on recommendations by plant protection experts (*Figure 1*). If experts are familiar with the farm's specific features, then the selection of pesticides based on experts' recommendations is to be the advised practice.

Figure 1. Selection of pesticides



Source: Authors calculations

However, it is worrying that as many as a quarter of respondents (25.7%) make their decisions solely based on personal experience. Excessive reliance of Vietnamese farmers on previous experience in creating crop protection strategies of pesticide selection was noticed by Haubraken and associates (Houbraken et al., 2016). They concluded that such practices are not sustainable in the long term and can affect production results, cause pest resistance, and pollute natural resources (Houbraken et al., 2016). Another group of authors noted that negative effects often result from farmers' bad habits (Huang et al., 2020). Considering the surveyed farmers in Vojvodina, it is important to observe the share of farmers who choose pesticides based on partly reliable sources, such as the Internet, the media, and recommendations by neighbours or relatives (*Figure 1*). All this shows that farmers need professional help in choosing pesticides. The easiest way to facilitate this is to further develop an agricultural extension service that offers free expert advice. Such a service already exists in Vojvodina, but it cannot reach every farmer since its capacities are very limited.

Once the pesticides have been selected, farmers should prepare and apply them to their plots. There are several steps in these phases that farmers must perform carefully and conscientiously. *Table 2* shows the results of the farmers' self-evaluation of their adherence to recommendations regarding different elements of pesticide handling.

Table 2. Self-assessment of adherence to pesticide handling recommendations

	NR*	MDR	NRNDR	MR	AFR	Mean	SD
Pre-harvest interval	0.0	0.0	0.5	1.6	97.9	4.97	0.2
Frequency of application	0.0	0.0	1.8	3.1	95.1	4.93	0.32
Washing and maintenance of equipment	0.3	1.0	0.8	5.2	92.7	4.89	0.46
Dosage	1.3	0.8	1.6	9.6	86.8	4.80	0.63
Application timing	0.3	0.0	2.1	17.4	80.3	4.77	0.50
Weather conditions	0.3	0.5	2.3	22.6	74.3	4.70	0.57
Packaging waste management	13.2	1.6	5.2	8.6	71.4	4.23	1.40
Personal safety protection	32.2	14.5	27.0	12.7	13.5	2.61	1.40

*NR - I do not respect at all; MDR – I mostly disrespect; NRNDR - I neither respect nor disrespect; MR - I mostly respect; AFR - I always fully respect

Source: Authors calculations

Over 95% of the respondents claim that they mostly or always follow the recommendations regarding the pre-harvest interval, frequency of application, recommended dosage, application timing, and weather conditions for the application of pesticides. Also, the vast majority of them consider that the way they wash and maintain equipment is in accordance with recommendations. It is dubious, however, how familiar farmers are with the latest recommendations, so such results should be interpreted with caution.

Unfortunately, a certain number of the respondents state that they do not act in accordance with the recommendations, which means that they consciously ignore them. In addition, the results of the research show that the respondents insufficiently adhere to recommendations regarding personal safety protection when handling pesticides. Only 26.2% of the farmers generally or always adopt such recommendations, while 46.7% do not. The fact that they do not use personal protective equipment (gloves, masks, clothing that covers most of the skin, appropriate footwear, hats) is usually justified by experiencing discomfort such as feeling hot (due to long legs and sleeves and wearing a hat), difficult breathing (under a mask), and limited manipulative abilities (due to wearing gloves). These results do not differ significantly from the results obtained in other similar studies which showed that farmers often fail to apply appropriate safety measures when handling pesticides, most often due to discomfort and unavailability of appropriate equipment (Blanco-Munoz, Lacasana, 2011; Bhandari et al., 2018; Sharif Sharifzadeh et al., 2019; Berni et al., 2020; Lari et al., 2020).

The vast majority of farmers (80%) claim that they mostly or always follow the recommendations regarding the handling of packaging waste from pesticides (*Table 2*). However, a closer look at the way packaging waste is handled indicates problems in this regard (*Table 3*). The data in *Table 3* show that only 17.1% of the surveyed farmers properly dispose of pesticide packaging waste, i.e., hand it over to competent subjects after appropriate pre-treatment. The most common way of managing used pesticide packaging includes pre-treatment in the form of triple rinsing, drilling of packaging,

and disposal, together with household waste (29.9%). This type of management of pesticide packaging waste, which belongs to hazardous waste by its characteristics, is not adequate. However, due to a lack of information[5] or practically non-existent options for proper managing of pesticide packaging waste (due to a lack of infrastructure), the conclusion might be that the respondents act conscientiously and in the best possible manner in the given circumstances. Criticism for this should be directed at those who are supposed to provide farmers with the necessary knowledge and information and create infrastructural preconditions for desirable behaviour.

Table 3. Ways of handling pesticide waste packaging (N = 385)

Ways of handling		%
After I wash it three times, I take it to the retailers or someone else who is in charge of its safe disposal.	I also drill it	17.1
	I don't drill it	9.1
After rinsing it three times, I throw it away with household waste.	I also drill it	29.9
	I don't drill it	9.9
After washing it three times, I take it to the landfill near the settlement.	I also drill it	7.5
	I don't drill it	0.5
Without prior preparation, I take it to the retailers or someone else who is in charge of its safe disposal.		1.0
Without prior preparation, I throw it away with household waste.		2.9
Without prior preparation, I take it to the landfill near the settlement.		1.6
Without prior preparation, I throw it in a field or a ditch.		0.5
I burn it.		19.2
I store it on the farm until it is taken away.		0.3
None of the above		0.5
Total		100.0

Source: Authors calculations

It is worrying that as many as 19.2% of the sample respondents burn pesticide packaging waste. This way of handling pesticide packaging waste has been observed by researchers in other populations, for example, among farmers in Vietnam (Houbraken et al., 2016) and in Iran (Bagheri et al., 2018). This is a practice that is dangerous for both the environment and the person involved in the process. Farmers are often aware that this practice is not an adequate way of disposing waste, but they justify this procedure by saying that it is impossible to do it in another way. The share of producers who dispose of pesticide packaging waste in a completely unacceptable way (throwing it in a ditch or a field; on landfills; with municipal waste without prior preparation; or keeping it on the farm) is relatively small. However, this represents an additional indication that there is still a lack of information among farmers about the practices they are not allowed to implement or about those they can and must implement to avoid the negative consequences discussed above.

5 As many as 90.6% of the respondents are not sure where and how they should properly dispose of their pesticide packaging waste.

The vast majority of the respondents, as many as 80.8%, claim that there are people who throw pesticide packaging waste in places that are not intended for that purpose. However, only 29.6% of the sample respondents would report someone doing that. Most often, the reason why they decide not to report such practices is either that they do not know those who do it or, if they do know them, they wish to avoid offending them.

Conclusion

The results of the research suggest that the vast majority of the surveyed farmers assess their handling of pesticides as mainly adequate, i.e., in accordance with recommendations. This refers to the compliance with pre-harvest intervals, dosage, application timing, frequency of application and weather conditions during application, and washing and maintaining the equipment used.

However, a large percentage of farmers stated that they mostly or never follow the recommendations regarding personal safety protection when handling pesticides. Although they are aware of harmful effects of pesticides on their own health, they do not apply protective equipment (gloves, long socks and sleeves, hats, masks) because they feel uncomfortable and restrained. Besides, the majority of the surveyed farmers do not know how to manage pesticide packaging waste properly. Most frequently, the farmers dispose of pesticide packaging waste together with their household waste (with or without prior treatment) simply because they do not know how to do it in a better way. Unfortunately, some farmers carry out dangerous procedures when managing packaging waste, such as burning, disposal on plots and in ditches, or storage on the farm. All these problems are largely caused by insufficient knowledge and information on the proper handling of pesticides, which supports the research hypothesis and clearly indicates that some institutional improvements are needed in this area.

Therefore, the education of farmers regarding the use of pesticides, in the form of various types of formal and informal education, may be recommended to decision-makers. In this process, the extension service should play a significant role. That is why it is important to encourage farmers to cooperate more with this service. Adequately informing farmers is also important, not only by using labels and pictograms on pesticide packaging that farmers often do not even understand, but also through various media channels where farmers will be offered information in ways they can comprehend.

The contribution of this study is in providing empirical data on and practical knowledge of Serbian farmers' behaviour regarding pesticide use. This material could support successful planning and policy-making in this area. Although this research cannot be considered a novelty in the EU, it is innovative in the context of the Western Balkan countries' reality. The obtained results are relevant and essential for policy intervention aimed at the promotion of safer pesticide use thus contributing to the advancement of environmental management in this region.

Like many others, this study is not exempted from limitations that should be noted. First, the study was based on a convenience sample, which means that the application

of its findings to the entire population of Serbian farmers is limited. Second, this research is based on farmers' assessment of their procedures in handling pesticides. Their perception does not necessarily have to correspond to reality since self-reporting studies are often limited by problems related to social desirability bias, consistency, and connection with actual behaviour. A better insight would definitely be gained by using the method of direct observation of farmers. However, at the moment, such research is not feasible due to its high cost.

Although we believe that the study has achieved its aims, there are many questions which should be answered in future research applying this survey's data. For example, one of them is the matter of differences in pesticide use behaviour among farmers regarding their gender, age, level of education, experience in agriculture, farm size, and farm type. Therefore, the final recommendation is that future studies should focus on the influence of demographic and farm characteristics on pesticide use behaviour among farmers.

Acknowledgements

Authors are grateful to all farmers who voluntarily accepted to participate in the survey. This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (contracts 451-03-68/2022-14/200117 and 451-03-68/2022-14/200148).

Conflict of interests

The authors declare no conflict of interest.

References

1. Adesodun, J.K., Davidson, D.A., & Hopkins, D.W. (2005). Micromorphological evidence for changes in soil faunal activity following application of sewage sludge and biocide. *Appl Soil Ecol*, 29(1), 39-45. https://doi.org/10.1016/j.apsoil.2004.09.004
2. Aktar, M.W., Sengupta, D., & Chowdhury, A. (2009). Impact of pesticides use in agriculture: their benefits and hazards. Interdiscip. *Toxicol,* 2(1), 1–12. https://doi.org/10.2478/v10102-009-0001-7
3. Bagheri, A., Emami, N., Allahyari, M., & Damalas, C. (2018). Pesticide handling practices, health risks, and determinants of safety behavior among Iranian apple farmers. *Hum. Ecol. Risk Assess,* 24(8), 1-15. doi: 10.1080/10807039.2018.1443265
4. Berni, I., Menouni, A., Ghazi El, I., Duca, R.C., Kestemont, M.P., Godderis, L., & Jaafari, E.S. (2021). Understanding farmers' safety behavior regarding pesticide use in Morocco. *Sustain. Prod. Consum,* 25, 471-483. https://doi.org/10.1016/j.spc.2020.11.019
5. Bhandari, G., Atreya, K., Yang, X., Fan, L., & Geissen, V. (2018). Factors affecting pesticide safety behaviour: The perceptions of Nepalese farmers and retailers. *Sci. Total Environ,* 631–632, 1560–1571. https://doi.org/10.1016/j.scitotenv.2018.03.144

6. Blanco-Munoz, J., & Lacasana, M. (2011). Practices in Pesticide Handling and the Use of Personal Protective Equipment in Mexican Agricultural Workers. *J. Agromedicine,* 16(2), 117-26. https://doi.org/10.1080/1059924X.2011.555282
7. Bourn, D., & Prescott, J. (2002). A Comparison of the Nutritional Value, Sensory Qualities, and Food Safety of Organically and Conventionally Produced Foods. *Crit. Rev. Food Sci. Nutr,* 42(1), 1–34. doi: 10.1080/10408690290825439
8. Carter, A.D. (2000). How pesticides get into water and proposed reduction measures. *Pestic Outlook.* 11, 149–157. https://doi.org/10.1039/B006243J
9. Carvalho, P.F., 2017. Pesticides, environment, and food safety. Food Energy Secur. 6(2), 48–60. https://doi.org/10.1002/fes3.108
10. Cooper, J., & Dobson, H. (2007). The benefits of pesticides to mankind and the environment. *Crop Protection,* 26(9), 1337-1348. https://doi.org/10.1016/j.cropro.2007.03.022
11. Damalas, C.A. (2009). Understanding benefits and risks of pesticide use. *Sci. Res. Essays,* 4 (10), 945-949. https://doi.org/10.5897/SRE.9000968
12. Despotović, J., Rodić, V., & Caracciolo, F. (2019). Factors affecting farmers' adoption of integrated pest management in Serbia: An application of the theory of planned behavior. *J. Clean. Prod,* 228, 1196-1205. https://doi.org/10.1016/j.jclepro.2019.04.149
13. Dinham, B. (2003). Growing vegetables in developing countries for local urban populations and export markets: Problems confronting small-scale producers. *Pest Manag. Sci,* 59(5), 575–582. https://doi.org/10.1002/ps.654
14. Đokić, D., Stanisavljević, R., Marković, J., Milenković, J., Terzić, D., Vasić, T., & Barać, S. (2018). Performance testing of field crop sprayers in the Rasina District. *Acta. Agric. Serb,* 23(45), 27-36. doi: 10.5937/AASer1845027D
15. EU (2019). Agricultural Markets Briefs No 16. Global food supply and demand Consumer trends and trade challenges. September 2019. Retrived June 1 2021, from https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/farming/documents/market-brief-food-challenges-sep2019_en.pdf
16. FAO, 2019. Agriculture and climate change – Challenges and opportunities at the global and local Level – Collaboration on Climate-Smart Agriculture. Rome. 52. Licence: CC BY-NC-SA 3.0 IGO. Retrived March 1, 2021 from http://www.fao.org/3/CA3204EN/ca3204en.pdf
17. FAO, WHO, 2008. Guidelines on Management Options for Empty Pesticide Containers. International Code of Conduct on the Distribution and Use of Pesticides. E-ISBN 978-92-5-106832-8 (pdf). Retrived March 1, 2021, from http://www.fao.org/3/bt563e/bt563e.pdf
18. Furlong, M., Tanner, M.C., Goldman, M.S., Bhudhikanok, S.G., Blair, A., Chade, A., Comyns, K., Hoppin, A.J., Kasten, M., Korell, M., Langston, J.W., Marras, C., Meng, C., Richards, M., Ross, G.W., Umbach, M.D., Sandler, P.D., & Kamel, F. (2015). Protective glove use and hygiene habits modify the associations of specific pesticides with Parkinson's disease. *Environ. Int.* 75, 144–150. http://dx.doi.org/10.1016/j.envint.2014.11.002

19. Giesy, J.P., Feyk, L.A., Jones, P.D., Kannan, K., & Sanderson, T. (2003). Review of the effects of endocrine-disrupting chemical in birds. *Pure Appl. Chem,* 75(11-12), 2287–2303. https://doi.org/10.1351/pac200375112287

20. Grung, M., Lin, Y., Zhang, H., Orderdalen Steen, A., Huang, J., Zhang, G., & Larssen, T. (2015). Pesticide levels and environmental risk in aquatic environments in China — A review. *Environ. Int,* 81, 87-97. https://doi.org/10.1016/j.envint.2015.04.013

21. Hou, B., & Wu, L. (2010). Safety impact and farmer awareness of pesticide residues. *Food Agr. Immunol,* 21(3), 191-200. https://doi.org/10.1080/09540105.2010.484858

22. Houbraken, M., Bauweraerts, I., Fevery, D., Van Labeke, M-C, & Spanoghe, P. (2016). Pesticide knowledge and practice among horticultural workers in the Lâm Đồng region, Vietnam: A case study of chrysanthemum and strawberries. *Sci. Total Environ,* 550, 1001–1009. http://dx.doi.org/10.1016/j.scitotenv.2016.01.183

23. Huang, Y., Luo, X., Tang, L., & Yu, W. (2020). The power of habit: does production experience lead to pesticide overuse? *Environ. Sci. Pollut. Res,* 27, 25287–25296. https://doi.org/10.1007/s11356-020-08961-4

24. Iwaniuk, A.N., Koperski, D.T., Cheng, K.M., Elliott, J.E., Smith, L.K., Wilson, L.K., & Wylie, D.R. (2006). The effects of environmental exposure to DDT on the brain of a songbird: changes in structures associated with mating and song. *Behav. Brain. Res,* 173(1), 1-10. doi: 10.1016/j.bbr.2006.05.026

25. John, M.E., Shaike, J.M. (2015). Chlorpyrifos: pollution and remediation. *Environ. Chem. Lett,* 13, 269–291. doi: 10.1007/s10311-015-0513-7

26. Karapandžin, J. (2019). Ekološka svest poljoprivrednih proizvođača u Vojvodini kao determinanta primene agroekoloških praksi. [in English: *Environmental awareness as a factor influencing the implementation of agri-environment practices among farmers in Vojvodina Province]*. PhD thesis. University of Novi Sad Faculty of Agriculture.

27. Karapandžin, J., & Rodić, V. (2017). Agroekološke prakse u Vojvodini [in English: Agri-environmental practices in Vojvodina). *Agroekonomika,* 46 (73), 55-68].

28. Kien, H.T. (2015). *Factors Influencing Safety Pesticide Use Behavior among Farmers in Thai Nguyen Province, Vietnam*. Faculty of Nursing Burapha University

29. Lari, S., Medithi, S., Dayal Kasa, Y., Pandiyan, A., & Jonnalagadda, P. (2020). Pesticide handling practices and self-reported morbidity symptoms among farmers. *Arch. Environ. Occup. Health,* 1-11. https://doi.org/10.1080/19338244.2020.1828245

30. Lechenet, M., Dessaint, F., Py, G., Makowski, D., & Munier-Jolain, N. (2017). Reducing pesticide use while preserving crop productivity and profitability on arable farms. *Nat. Plant,*. 3, 17008. https://doi.org/10.1038/nplants.2017.8

31. Macharia, I., Mithofer, D., & Waibel, H. (2013). Pesticide handling practices by vegetable farmer in Kenya. *Environ. Dev. Sustain,* 15(4), 887–902. https://doi.org/10.1007/s10668-012-9417-x

32. Mello, M.F., & Scapini, R. (2016). Reverse Logistics of Agrochemical Pesticide Packaging and the Impacts to the Environment. *BJO&PM,* 13(1), 110-117. https://doi.org/10.14488/BJOPM.2016.v13.n1.a13

33. Nicol, A.-M. (2003). *Perceptions of pesticides among farmers and farm family members*. University of British Columbia Faculty of Medicine.

34. Oruç, E.Ö. (2010). Oxidative stress, steroid hormone concentrations and acetylcholinesterase activity in Oreochromis niloticus exposed to chlorpyrifos. Pestic. *Biochem. Physiol,* 96(3), 160-166. https://doi.org/10.1016/j.pestbp.2009.11.005

35. Ozkan, H.E. (2009). Current Status and Future Trends in Pesticide Application Technology. Proceedings of the *International Commission of Agricultural and Biological Engineers, Section V. Conference "Technology and Management to Increase the Efficiency in Sustainable Agricultural Systems*", Rosario, Argentina

36. Patarasiriwong, V., Wongpan, P., Korpraditskul, R., & Jeerapong, L. (2013). Pesticide Packaging Waste Management Model for Thailand. *Journal of Environmental Science and Engineering* B. 2, 1-6

37. Prăvălie, R., Patriche, C., Borrelli, P., Panagos, P., Roșca, B., Dumitraşcu, M., Nita, I.A., Săvulescu, I., Birsan, M.V., & Bandoc,G. (2021). Arable lands under the pressure of multiple land degradation processes. A global perspective. *Environ. Res,* 194, 110697. https://doi.org/10.1016/j.envres.2020.110697

38. Roca, A. (2011). *A socio-psychological study of adoption of farmers' agro-biodiversity friendly practices in Flanders*. Ghent University

39. Roettele, M., Laabs, V., & Rutherford, S. (2018). The importance of sprayer inspections in the EU from a chemical industry perspective. *Seventh European Workshop on Standardised Procedure for the Inspection of Sprayers – SPISE* 7 (37-44), Athens, Greece

40. Salvatore, A.L., Bradman, A., Castorina, R., Camacho, J., López, J., Barr, D.B., Snyder, J., Jewell, N. P., & Eskenazi, B. (2008). Occupational behaviors and farmworkers' pesticide exposure: findings from a study in Monterey County, California. *Am. J. Ind. Med.* 51(10), 782–794. https://doi.org/10.1002/ajim.20622

41. Sapbamrer, R. & Thammachai, A. (2020). Factors affecting use of personal protective equipment and pesticide safety practices: A systematic review. *Environ. Res,* 185, 109444. https://doi.org/10.1016/j.envres.2020.109444

42. Screpanti, C., Accinelli, C., Vicari, A., & Catizone, P. (2005). Glyphosate and glufosinateammonium runoff from a corn-growing area in Italy. *Agron. Sustain. Dev,* 25(3), 407-412

43. Sharif Sharifzadeh, M., Abdollahzadeh, G., Damalas, C., Rezaei, R., & Ahmadyousefi, M. (2019). Determinants of pesticide safety behavior among Iranian rice farmers. *Science of The Total Environment,* 651(2), 2953-2960. https://doi.org/10.1016/j.scitotenv.2018.10.179

44. Sharma, A., Kumar, V., Shahzad, B., Tanveer, M., Sidhu, Singh, G. P., Handa, N., Kohli, S., Yadav, P., Bali, A., Parihar, R., Dar, O., Singh, K., Jasrotia, S., Bakshi, P., Ramakrishnan, M., Kumar, S., Bhardwaj, R., & Thukral, A. (2019). Worldwide pesticide usage and its impacts on ecosystem. *SN Appl. Sci,* 1, 1446. https://doi.org/10.1007/s42452-019-1485-1

45. SORS - Statistical Office of the Republic of Serbia, (2012). Agricultural Land in the Republic of Serbia, *Census of Agriculture 2012*. Retrieved January 4, 2022, from https://popispoljoprivrede.stat.rs/?lang=en

46. Syed, J.H., Alamdar, A., Mohammad, A., Ahad, K., Shabir, Z., Ahmed, H., Ali, S. M., Sani, S.G.A.S., Bokhari, H., Gallagher, K.D., Ahmad, I., Eqani, & S.A.M.A.S. (2014). Pesticide residues in fruits and vegetables from Pakistan: a review of the occurrence and associated human health risks. *Environ. Sci. Pollut,* 21, 13367–13393. https://doi.org/10.1007/s11356-014-3117-z

47. Timprasert, S., Datta, A., & Ranamukhaarachchi, S.L. (2014). Factors determining adoption of integrated pest management by vegetable growers in Nakhon Ratchasima Province, Thailand. *Crop Prot,* 62, 32-39. http://dx.doi.org/10.1016/j.cropro.2014.04.008

48. UN - United Nations, Department of Economic and Social Affairs, Population Division, 2019. *World Population Prospects 2019*: Highlights (ST/ESA/SER.A/423). Retrived March 1, 2021, from https://population.un.org/wpp/Publications/Files/WPP2019_Highlights.pdf

49. Vischetti, C., Coppola, L., Monaci, E., Cardinali, A., & Castillo, M.d.P. (2007). Microbial impact of the pesticide chlorpyrifos on Swedish and Italian biobeds. *Agron. Sustain. Dev.* 27, 267–272. https://doi.org/10.1051/agro:2007020

50. Zala, S.M., & Penn, D.J. (2004). Abnormal behaviours induced by chemical pollution: a review of the evidence and new challenges. *Anim. Behav,* 68(4), 649–64. https://doi.org/10.1016/j.anbehav.2004.01.005

ECONOMIC EFFICIENCY ASSESSMENT OF INVESTMENTS IN AGRICULTURAL PRODUCTION

Boris Kuzman[1], Mirela Momčilović[2], Dajana Ercegovac[3], Dragana Milić[4]

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

ARTICLE INFO

Original Article

Received: *30 June 2022*

Accepted: *30 September 2022*

doi: 10.59267/ekoPolj230161K

UDC 631.164

Keywords:

investment evaluation, corn and soybean cultivation

***JEL**: D22, G31*

ABSTRACT

The purpose of this study is to assess the economic benefits of agricultural production and provide guidance to manufacturers and investors interested in agriculture. This paper applies dynamic efficiency evaluation methods i.e. net present value, profitability index, and internal rate of return, together with the sensitivity analysis that is useful in cases of market turbulences. The presented investment is purchasing 10 hectares of arable land and cultivating two alternative crops: corn and soybeans. Research results and projections imply that both scenarios are acceptable and economically profitable with the preference for the cultivation of corn giving better economic efficiency. This study can provoke further investment evaluations with dynamic capital budgeting methods in other crops or implementation of mechanization in agricultural production.

Introduction

Agricultural production is a significant pillar of the Serbian economy and exports. This is in line with Mihailović et al. (2014) who stated that primary agricultural production is the important determinant of the national economy, mainly due to its share in GDP and total employment, where agricultural production together with the food industry represents over 15% of Serbian GDP.

1 Boris Kuzman, PhD, Associate Professor, Institute of Agricultural Economics, Volgina Street 15, 11060 Belgrade, Serbia, Phone: +38163299111, E-mail: kuzmanboris@yahoo.com, ORCID ID (https://orcid.org/0000-0002-8661-2993)

2 Mirela Momčilović, PhD, Lecturer, Novi Sad Business School, Vladimira Perića Valtera 4, 21000 Novi Sad, Serbia, Phone: +38163280010, E-mail: bizniscentar@gmai.com, ORCID ID (https://orcid.org/0000-0001-5752-6992)

3 Dajana Ercegovac, PhD, Lecturer, Novi Sad Business School, Vladimira Perića Valtera 4, 21000 Novi Sad, Serbia, Phone: +381649834010, E-mail: ercegovacdajana@gmai.com, ORCID ID (https://orcid.org/0000-0002-6526-0773)

4 Dragana Milić, PhD, Lecturer, Novi Sad Business School, Vladimira Perića Valtera 4, 21000 Novi Sad, Serbia, Phone: +381638215979, E-mail: draganaim84@gmail.com, ORCID ID (https://orcid.org/0000-0001-8250-0479)

Ercegovac & Živkov (2018) based on data from the Statistical Office of the Republic of Serbia find that agricultural products, food, and raw materials were over 20% of national exports in 2016 and 2017. Study of Marković et al. (2022) imply that Serbian agri-food exports are resilient in the crisis situation (e.g. corona pandemic, 2019-2020).

Further development of the Serbian agriculture sector requires a significant increase in the agricultural budget and allocation of resources into investments for plant and livestock production and rural development programs (Kuzman et al., 2017). Investments are the base of the economic development and growth of companies with a close connection to a higher level of risks because of longer time duration and uncertain business conditions (Pantić et al., 2022; Момчиловић & Ерцеговац, 2022; Pavlović et al., 2021). Larger investments in Serbian agricultural holdings will contribute to food security, significant economic growth, greater exports, increase in employment in rural areas, and provide ecological equilibrium (Dašić et al., 2022). Profitable agricultural production is the base of the growth of national agricultural companies and individual producers. This study focus on the economic efficiency of agricultural production in order to help manufacturers to assess the benefits of investing in corn and soybean production. This research is also useful to a broad range of investors and researchers interested in financial analysis with dynamic efficiency methods like net present value, profitability index, and internal rate of return with sensitivity analysis which is applicable in cases of market uncertainty.

The paper is structured in four main sections where the first present the literature review; the second part describes data and used methodology; the third part provides the authors results and projections covering the structure of financing, loan repayment, the weighted average cost of capital, revenue and cost projections, income statement, cash flow, economic flow, and dynamic efficiency parameters of investments. After the results, in discussion the authors give an economic interpretation and comparison of two analyzed scenarios with implications for the decision-making of producers and investors. In concluding remarks the authors point out that both investment scenarios are acceptable giving the preference to the first scenario, investing in 10 hectares (ha) of arable land and cultivation of corn.

Literature review

There are useful studies, both in domestic and foreign literature, that analyze and evaluate the economic efficiency of investments. Novković et al. (2006) examined the economic effects of investing in silo capacity expansion with the conclusion that the investment should be undertaken because the payback period is slightly higher than five years, the net present value of the investment is around 190,000 euros, and the internal rate of return is 13.01%. Novković et al. (2017) investigated the economic efficiency of investing in hazelnut plantation in the period of 10 years on an area of 0.5 hectares and the results showed that the project has a positive net present value of 1,212,200 dinars, the internal rate of return of the project is 16.97% with a payback period of eight years i.e. this project can be assessed as profitable. Vlaović Begović et al. (2018) assessed the economic efficiency

of purchasing 10 hectares of agricultural land for corn cultivation using several dynamic methods of capital budgeting with the following results and conclusion: the net present value of the investment is 43,415 euros, the internal rate of return is 9.91%, the profitability index is 1.22, which imply that this investment should be implemented. Baruwa and Fabode (2019) evaluated the investments in the layer and broiler production with results that showed that both investments are acceptable but the investment in layer production has a higher, positive net present value and the value of the internal rate of return compared to the investment in the production of broilers, as well as a shorter discounted payback period. Lopes Santos et al. (2020) investigated two soybean cultivation systems using three different price scenarios and discounted cash flows of the investment (which includes the net present value method), as well as cost-volume-profit analysis. The authors point out that soybean production is profitable, with different strategies, property production profiles and price scenarios, if it is performed on land size between 29 ha, and 1,065 ha.

Subić (2017) examined the economic efficiency of purchasing agricultural land, as well as the procurement of machinery for agricultural production. On the base of dynamic efficiency methods and investment evaluation methods in conditions of uncertainty, author find that investment is justified in all analyzed cases. Subić et al. (2017) evaluated two investment scenarios: conventional raspberry plantations vs raspberry plantations that include investing in a mobile solar robotic generator. The assessment of the investment projects was performed using the net present value, internal rate of return, payback period, and break-even point with the conclusion that investing in a renewable electrical energy device during the production of raspberries, has a high economic justification. Besides traditional agricultural production, Radić et al. (2022) highlighted the potentials and challenges of the "smart agriculture" i.e. Internet of Things, big data, satellite navigation, mobile communications, and ubiquitous computing in agriculture. New trends of a demographic boom, fast urbanization, and increased demand for food, induced the efforts in developing sustainable technologies that would improve production, increase yields, direct efficient water use and provide more efficient agricultural operations.

Materials and methods

The investment project evaluated in this paper is being conducted for the private company "X" founded in 1994 and located in the area of Stara Pazova municipality. The main activity of the company is farming and agricultural production. The company considers investing in 10 ha of arable land and cultivating corn or soybeans. Therefore, a comparative analysis of the cultivation of corn against soybean is done in the paper. For this purpose, two scenarios are assessed based on the project's economic life of 10 years. Projection of the income statement, cash, and economic flow of the investment project is carried out, and the project is evaluated based on the net present value, profitability index, and internal rate of return. Net present value as the investment evaluation method is broadly used (see e.g. Peterson & Fabozzi, 2002; Damodaran, 2015; Todorović & Ivanišević, 2018; CFA Institute, 2020). Profitability index as a relative measure with fewer shortcomings compared to an internal rate of return (see Peterson & Fabozzi,

2002) is also used in this paper. *Table 1* presents the formulas used for the assessment of the acceptability of an investment. These methods are chosen since they are the most often used dynamic methods for investment evaluation in Serbia according to the survey of 64 companies performed by Todorovic et al. (2015). There are similar studies about investment decision-making, see e.g. Graham & Harvey, 2001; Dedi & Orsag, 2007; Correia, 2012; Andres, Fuente & San Matin, 2015; Tešić et al., 2021). Evaluation of investments also includes the use of sensitivity analyses to assess investment efficiency in uncertain conditions. This method is selected due to the instability of the commodity markets caused by the war in Ukraine, increasing inflation, and global supply chain problems that were present from the beginning of 2022.

Table 1. The methods used for the evaluation of investment projects

Methods	Symbol	Formula	Acceptance rule
Net present value	NPV	$NPV = \sum_{t=1}^{n} \frac{NNT_t}{(1+r)^t} - C$	$NPV \geq 0$
Profitability index	PI	$PI = \frac{\sum_{t=1}^{n} \frac{NNT_t}{(1+r)^t}}{C}$	$PI \geq 1$
Internal rate of return	IRR	$C = \sum_{t=1}^{n} \frac{NNT_t}{(1+IRR)^t}$	$IRR \geq r$

Source: Stančić, Čupić (2020).

Note: NNT_t represents net inflow or net cash flow of the project, C is a total investment, r is the discount rate, and n represents the expected economic life of the project.

The project is financed through a combination of equity (own capital), and debt. In *Table 2* is presented the assessment of the investment discount rate. The discount rate is determined based on the weighted average cost of capital (WACC) formula. The cost of the equity is determined based on the capital asset pricing model (CAPM), and its beta is calculated based on the formula for a levered beta.

Table 2. The assessment of investment discount rate

Methods	Formula
WACC	$r = \frac{E}{V} r_e + \frac{D}{V} r_d (1-t)$; $V = E + D$
CAPM	$r_e = r_f + \beta_L (r_m - r_f)$
Levered beta	$\beta_L = \beta_U (1 + (1-t)\frac{D}{E}$.

Source: Damodaran (2005).

Note: rr is the discount rate, E is equity, D is debt, V is the total value of invested capital, r_e represents the cost of equity, r_d represents the cost of debt, r_f is the risk-free rate of return, r_m represents the rate of return of the market portfolio, β_L is levered beta, β_U is unlevered beta, and t represents tax rate.

Data necessary for the calculations is obtained based on the interview with the management of the company "X" and internet sources. All values displayed in the paper are expressed in EUR. The price of 1 ha of arable land in the area of Stara Pazova municipality is 20.000 EUR. The project is financed 70 percent from equity, and 30 percent from credit arrangement. *Table 3* presents the current prices of corn and soybean, as well as their yield. *Table 4* presents data necessary for the determination of variable cost. Fixed costs encompass assessed wages for the employees at the level of 500 EUR for 10 ha. Amortization of the land is not included in the fixed costs, because land does not lose value with exploitation. Projection of revenues, variable and fixed costs are done based on the growth rate that is equal to expected inflation in the EU according to data from Statista, (2022): 1.89 percent in 2022, 1.61 percent in 2023, 1.72 percent in 2024, 1.78 percent in 2025, 1.85 percent in 2026. The inflation for the remaining years of the economic life of the investment is determined as the average of inflation rates in previous years of the project. The cost of debt (external capital) is based on the interest rate of 4.75 percent on the loan that matures in 10 years. As an approximation for the risk-free rate is taken the yield on the 10-year German government-owned bond 0.945 percent (Trading Economics, 2022). The equity risk premium for the German market amounts to 4.24 percent, the country risk premium for Serbia is 2.97 percent and the unlevered beta for emerging markets for agriculture and farming is 0.74 (Damodaran, 2022).

Table 3. Prices and yields of corn and soybean

Indicators	Corn (EUR/ton)	Soybean (EUR/ton)
Price in EUR/ton, 30.04.2022.	288.93	713.82
Yield (ton/ha)	11.00	3.50

Source: Current prices are obtained from NS COMEX, 2022. Yield data are obtained from the management of the company, 2022.

Table 4. The variable cost data

Variable costs	Corn (EUR/ha)	Soybean (EUR/ha)
Raw materials		
- Seed	186.95	115.57
- Mineral fertilizer (and urea)	607.90	200.00
- Pesticides	50.99	50.99
Mechanical work		
- Plowing	101.97	101.97
- Sowing	33.99	33.99

Variable costs	Corn (EUR/ha)	Soybean (EUR/ha)
- Spraying	50.99	50.99
- Cultivation	25.49	25.49
- Harvesting	93.48	100.00
- Piking and transport	100.00	100.00
- Preparation	33.99	33.99

Source: Data obtained from the management of the company, 2022.

Results

The total investment within the two observed scenarios differed in absolute values of investment, but the differences are small and come from the investment in working capital. According to the two observed scenarios, it is necessary to invest approximately 210,000 EUR (*Table 5*). The company intended to finance 30 percent of the total investment from the bank loan. External capital is used for purchasing the land, while own capital is used for the financing of the working capital, and remaining investment in land (*Table 6*).

Table 5. The structure of investments in corn and soybean cultivation

No	Indicators	Scenario 1		Scenario 2	
		Amount (EUR)	Share (%)	Amount (EUR)	Share (%)
I	Fixed assets	200,000	94	200,000	96
1.	Land 10 ha	200,000	94	200,000	96
II	Working capital	13,358	6	8,630	4
	Total:	213,358	100	208,630	100

Source: Authors' calculation

Table 6. The structure of financing sources of investments

No	Indicators	Scenario 1		Scenario 2	
		Amount (EUR)	Share (%)	Amount (EUR)	Share (%)
I	**Own capital**	149,350	70	146,041	70
1.	Land 10 ha	135,993	64	137,411	66
2.	Working capital	13,358	6	8,630	4
II	**External capital**	64,007	30	62,589	30
1.	Land 10 ha	64,007	30	62,589	30
	Total:	213,358	100	208,630	100

Source: Authors' calculation

To finance the project, a loan is provided from a commercial bank with an interest rate of 4.75 percent, and a repayment period of 10 years. The repayment is done in equal annuities. The difference between determined annuities of the loan for two scenarios comes from the difference between initial amounts of loans for the growth of corn, and soybean (*Table 7*).

Table 7. The loan repayment dynamics (in EUR)

No	Description	Years									
		1	2	3	4	5	6	7	8	9	10
Scenario 1											
1	Interest expense	3,040	2,796	2,540	2,271	1,990	1,696	1,387	1,064	726	371
2	Debt repayment	5,149	5,393	5,649	5,918	6,199	6,493	6,802	7,125	7,463	7,818
	Total:	**8,189**	**8,189**	**8,189**	**8,189**	**8,189**	**8,189**	**8,189**	**8,189**	**8,189**	**8,189**
Scenario 2											
1	Interest expense	2,973	2,734	2,483	2,221	1,946	1,658	1,357	1,041	710	363
2	Debt repayment	5,034	5,274	5,524	5,786	6,061	6,349	6,651	6,967	7,298	7,644
	Total:	**8,007**	**8,007**	**8,007**	**8,007**	**8,007**	**8,007**	**8,007**	**8,007**	**8,007**	**8,007**

Source: Authors' calculation

Levered beta is calculated based on Damodaran's emerging markets unlevered beta for agriculture and farming, the D/E ratio of the project, and an income tax rate of 15 percent, and it amounted to a little above 1. The cost of equity is determined based on the CAPM formula, and it amounted to 8.20 percent for both scenarios (*Table 8*). The cost of debt represented the bank interest rate corrected for the income tax rate of 15 percent, which amounted to 4.04 percent for both scenarios. From *Table 9*, it can be seen that the weighted average cost of capital is 6.95 percent.

Table 8. The cost of equity

No	Indicators	Scenario 1	Scenario 2
1	Unlevered beta for agriculture and farming	0.74000	0.74000
2	Tax rate (15%)	0.15000	0.15000
3	D/E	0.42857	0.42857
	Levered beta	**1.00957**	**1.00957**
1	Risk-free rate for German market	0.00945	0.00945
2	Levered beta	1.00957	1.00957
2	Equity risk premium for German market	0.00424	0.00424
3	Serbian country risk premium	0.00297	0.00297
	CAPM	**0.08196**	**0.08196**

Source: Authors' calculation

Table 9. The weighted average cost of capital

No	Indicators	Scenario 1			Scenario 2		
		Share (%)	Interest rate (%)	Discount rate (%)	Share (%)	Interest rate	Discount rate (%)
I	Own capital	70 99,300	8.20	5.74	70 95,99130	8.20	5.74
II	External capital	30	4.04	1.21	30	4.04	1.21
	Total:	**100**		**6.95**	**100**		**6.95**

Source: Authors' calculation

The total revenue for the first year of the project is determined for both scenarios based on the expected yields, and redemption prices of corn/soybeans, while the projection of the revenue for the remaining years is done by correcting the revenue for the expected rate of inflation in EU. *Table 10* presents obtained results, and it shows that corn cultivation resulted in a higher level of sales revenue compared to soybean cultivation.

Table 10. The projected revenue of investments (in EUR)

No	Description	Years									
		1	2	3	4	5	6	7	8	9	10
Scenario 1											
1	Revenue from sales	36,116	36,697	37,329	37,993	38,696	39,381	40,078	40,787	41,509	42,244
	Total:	**36,116**	**36,697**	**37,329**	**37,993**	**38,696**	**39,381**	**40,078**	**40,787**	**41,509**	**42,244**
Scenario 2											
1	Revenue from sales	29,980	30,463	30,987	31,539	32,122	32,691	33,269	33,858	34,457	35,067
	Total:	**29,980**	**30,463**	**30,987**	**31,539**	**32,122**	**32,691**	**33,269**	**33,858**	**34,457**	**35,067**

Source: Authors' calculation

Table 11 presents the structure of the total costs of investment in the cultivation of corn/soybean at 10 ha of land. Cultivation of corn required substantial investment in material costs. The majority of corn production material costs came from the cost of mineral fertilizers, urea, and seed. On the other hand, in the first years of the economic life of corn cultivation, the highest immaterial cost was interest, but it is reduced as the loan gets paid off. Significant immaterial costs of corn cultivations were costs of plowing, picking, transporting, and harvesting.

The cultivation of soybean had lower material costs compared with the material costs of corn cultivation (*Table 11*). The most significant material cost in soybean cultivation was the cost of mineral fertilizers. The interest cost was the most substantial immaterial

cost of soybean cultivation in the first years of the economic life of the project. However, it is reduced with the repayment of the loan. Costs of plowing, harvesting, picking and transport in soybean cultivation were considerable, as in corn cultivation. It should be pointed out that the total costs of soybean cultivation were lower compared to corn cultivation, due to lower material costs.

Table 11. The projected costs of investments (in EUR)

No	Description	Years									
		1	2	3	4	5	6	7	8	9	10
Scenario 1											
I	**Material costs**	**8,458**	**8,595**	**8,742**	**8,898**	**9,063**	**9,223**	**9,386**	**9,552**	**9,721**	**9,894**
1	Seed	1,870	1,900	1,932	1,967	2,003	2,039	2,075	2,111	2,149	2,187
2	Mineral fertilizers	6,079	6,177	6,283	6,395	6,513	6,629	6,746	6,865	6,987	7,110
3	Pesticides	510	518	527	536	546	556	566	576	586	596
II	**Immaterial costs**	**7,939**	**7,774**	**7,603**	**7,425**	**7,239**	**7,038**	**6,824**	**6,597**	**6,357**	**6,102**
1	Plowing	1,020	1,036	1,054	1,073	1,093	1,112	1,132	1,152	1,172	1,193
2	Sowing	340	345	351	358	364	371	377	384	391	398
3	Spraying	510	518	527	536	546	556	566	576	586	596
4	Cultivation	255	259	263	268	273	278	283	288	293	298
5	Harvesting	935	950	966	983	1,002	1,019	1,037	1,056	1,074	1,093
6	Piking and transport	1,000	1,016	1,034	1,052	1,071	1,090	1,110	1,129	1,149	1,170
7	Preparation	340	345	351	358	364	371	377	384	391	398
8	Labor	500	508	517	526	536	545	555	565	575	585
9	Interest	3,040	2,796	2,540	2,271	1,990	1,696	1,387	1,064	726	371
	Total (I+II):	**16,398**	**16,368**	**16,346**	**16,323**	**16,302**	**16,261**	**16,210**	**16,149**	**16,078**	**15,995**
Scenario 2											
I	**Material costs**	**3,666**	**3,725**	**3,789**	**3,856**	**3,927**	**3,997**	**4,068**	**4,140**	**4,213**	**4,288**
1	Seed	1,156	1,174	1,195	1,216	1,238	1,260	1,282	1,305	1,328	1,352
2	Mineral fertilizers	2,000	2,032	2,067	2,104	2,143	2,181	2,219	2,259	2,299	2,339
3	Pesticides	510	518	527	536	546	556	566	576	586	596
II	**Immaterial costs**	**7,937**	**7,778**	**7,614**	**7,443**	**7,265**	**7,071**	**6,866**	**6,647**	**6,415**	**6,170**
1	Plowing	1,020	1,036	1,054	1,073	1,093	1,112	1,132	1,152	1,172	1,193
2	Sowing	340	345	351	358	364	371	377	384	391	398
3	Spraying	510	518	527	536	546	556	566	576	586	596
4	Cultivation	255	259	263	268	273	278	283	288	293	298
5	Harvesting	1,000	1,016	1,034	1,052	1,071	1,090	1,110	1,129	1,149	1,170
6	Piking and transport	1,000	1,016	1,034	1,052	1,071	1,090	1,110	1,129	1,149	1,170
7	Preparation	340	345	351	358	364	371	377	384	391	398
8	Labor	500	508	517	526	536	545	555	565	575	585
9	Interest	2,973	2,734	2,483	2,221	1,946	1,658	1,357	1,041	710	363
	Total (I+II):	**11,603**	**11,503**	**11,403**	**11,299**	**11,193**	**11,068**	**10,933**	**10,787**	**10,628**	**10,457**

Source: Authors' calculation

Table 12 presents the projection of income statement for both scenarios that include buying 10 ha of arable land and growing corn or soybean. It can be seen from *Table 12* that both investment scenarios had a positive financial result in all years of the economic life of the project. However, according to the projected statements, the cultivation of corn is more profitable.

Table 12. The income statement of investments (in EUR)

No	Description	Years									
		1	2	3	4	5	6	7	8	9	10
Scenario 1											
1	**Total revenue**	**31,782**	**32,294**	**32,849**	**33,434**	**34,052**	**34,655**	**35,268**	**35,893**	**36,528**	**37,175**
1.1	Operating revenue	31,782	32,294	32,849	33,434	34,052	34,655	35,268	35,893	36,528	37,175
2	**Total expenses**	**16,398**	**16,368**	**16,346**	**16,323**	**16,302**	**16,261**	**16,210**	**16,149**	**16,078**	**15,995**
2.1.	Operating expenses (2.1.1+2.1.2 +2.1.3+2.1.4)	13,358	13,573	13,806	14,052	14,312	14,565	14,823	15,085	15,352	15,624
	2.1.1 Material cost	8,458	8,595	8,742	8,898	9,063	9,223	9,386	9,552	9,721	9,894
	2.1.2 Depreciation	0	0	0	0	0	0	0	0	0	0
	2.1.3 Immat. cost without interest*	4,899	4,978	5,064	5,154	5,249	5,342	5,437	5,533	5,631	5,730
3	**Operating profit**	**18,424**	**18,721**	**19,043**	**19,382**	**19,741**	**20,090**	**20,446**	**20,808**	**21,176**	**21,551**
4	Financial expenses	3,040	2,796	2,540	2,271	1,990	1,696	1,387	1,064	726	371
5	**Profit before taxes**	**15,384**	**15,925**	**16,503**	**17,111**	**17,750**	**18,394**	**19,058**	**19,743**	**20,450**	**21,179**
6	Income taxes (15%)	2,308	2,389	2,476	2,567	2,663	2,759	2,859	2,961	3,067	3,177
7	**Net profit**	**13,076**	**13,537**	**14,028**	**14,544**	**15,088**	**15,635**	**16,200**	**16,782**	**17,382**	**18,002**
Scenario 2											
1	**Total revenue**	**24,984**	**25,386**	**25,823**	**26,282**	**26,768**	**27,242**	**27,724**	**28,215**	**28,715**	**29,223**
1.1	Operating revenue	24,984	25,386	25,823	26,282	26,768	27,242	27,724	28,215	28,715	29,223
2	**Total expenses**	**11,603**	**11,503**	**11,403**	**11,299**	**11,193**	**11,068**	**10,933**	**10,787**	**10,628**	**10,457**
2.1.	Operating expenses (2.1.1+2.1.2 +2.1.3+2.1.4)	8,630	8,769	8,920	9,078	9,246	9,410	9,577	9,746	9,919	10,094
	2.1.1 Material cost	3,666	3,725	3,789	3,856	3,927	3,997	4,068	4,140	4,213	4,288
	2.1.2 Depreciation	0	0	0	0	0	0	0	0	0	0
	2.1.3 Immat. cost without interest*	4,964	5,044	5,131	5,222	5,319	5,413	5,509	5,606	5,706	5,807
3	**Operating profit**	**16,354**	**16,617**	**16,903**	**17,204**	**17,522**	**17,832**	**18,148**	**18,469**	**18,796**	**19,129**
4	Financial expenses	2,973	2,734	2,483	2,221	1,946	1,658	1,357	1,041	710	363
5	**Profit before taxes**	**13,381**	**13,883**	**14,419**	**14,983**	**15,576**	**16,174**	**16,791**	**17,428**	**18,086**	**18,765**
6	Income taxes (15%)	2,007	2,082	2,163	2,247	2,336	2,426	2,519	2,614	2,713	2,815
7	**Net profit**	**11,374**	**11,801**	**12,257**	**12,735**	**13,240**	**13,748**	**14,272**	**14,814**	**15,373**	**15,951**

Source: Authors' calculation

Note:* Immaterial costs do not contain the interest cost of the loan (financial expenses).

The cash flow of the two proposed investments is presented in *Table 13*. The table shows that two scenarios generated a positive net inflow in each observed year of the cash flow statement. In the last year, both scenarios had significantly higher net inflow compared to previous years, because of the high level of land's residual value, as well as the residual value of working capital. The residual value of land was significant because it does not lose value with its use. It should be pointed out that the corn cultivation project had a higher level of cumulative cash flow compared to the project of soybean cultivation (303,625 EUR compared to 281,605 EUR).

From *Table 14*, it can be seen that the net inflows of the economic flow statement were positive in all years of the economic life of both scenarios, except in the year of implementation of investments. Negative net inflow in year zero of two scenarios results from the investment that amounts to 213,358 EUR in case of corn production and 208,630 EUR in case of soybean production. The total cumulative net inflow of the first scenario was higher compared to the second scenario (172,156 EUR compared to 153,049 EUR).

Table 13. The cash flow of investments (in EUR)

No	Description	Years										
		0	1	2	3	4	5	6	7	8	9	10
Scenario 1												
I	**Total inflow**	**213,358**	**31,782**	**32,294**	**32,849**	**33,434**	**34,052**	**34,655**	**35,268**	**35,893**	**36,528**	**250,532**
1	Total revenue	0.00	31,782	32,294	32,849	33,434	34,052	34,655	35,268	35,893	36,528	37,175
2	Sources of financing	213,358										
2.1	Own capital	149,350										
2.2	External capital	64,007										
3	Residual value											213,358
3.1	Fixed assets											200,000
3.2	Working capital											13,358
II	**Total outflow**	**213,358**	**23,854**	**24,150**	**24,470**	**24,807**	**25,163**	**25,513**	**25,870**	**26,236**	**26,609**	**26,990**
1	Value of investment	213,358										
2	Material costs		8,458	8,595	8,742	8,898	9,063	9,223	9,386	9,552	9,721	9,894
3	Immat. costs without inter.		4,899	4,978	5,064	5,154	5,249	5,342	5,437	5,533	5,631	5,730
4	Loan liabilities		8,189	8,189	8,189	8,189	8,189	8,189	8,189	8,189	8,189	8,189
5	Income tax (15%)		2,308	2,389	2,476	2,567	2,663	2,759	2,859	2,961	3,067	3,177
III	**Net inflow (I-II)**	**0**	**7,928**	**8,143**	**8,379**	**8,627**	**8,889**	**9,142**	**9,398**	**9,657**	**9,919**	**223,542**
Scenario 2												
I	**Total inflow**	**208,630**	**24,984**	**25,386**	**25,823**	**26,282**	**26,768**	**27,242**	**27,724**	**28,215**	**28,715**	**237,853**
1	Total revenue	0	24,984	25,386	25,823	26,282	26,768	27,242	27,724	28,215	28,715	29,223
2	Sources of financing	208,630										
2.1	Own capital	146,041										
2.2	External capital	62,589										
3	Residual value											208,630
3.1	Fixed assets											200,000
3.2	Working capital											8,630
II	**Total outflow**	**208,630**	**18,645**	**18,859**	**19,090**	**19,333**	**19,590**	**19,844**	**20,103**	**20,368**	**20,639**	**20,917**
1	Value of investment	208,630										
2	Material costs		3,666	3,725	3,789	3,856	3,927	3,997	4,068	4,140	4,213	4,288
3	Immaterial costs without inter.		4,964	5,044	5,131	5,222	5,319	5,413	5,509	5,606	5,706	5,807
4	Loan liabilities		8,007	8,007	8,007	8,007	8,007	8,007	8,007	8,007	8,007	8,007

No	Description	Years										
		0	1	2	3	4	5	6	7	8	9	10
5	Income tax (15%)		2,007	2,082	2,163	2,247	2,336	2,426	2,519	2,614	2,713	2,815
III	**Net inflow (I-II)**	**0**	**6,339**	**6,527**	**6,732**	**6,949**	**7,178**	**7,399**	**7,622**	**7,847**	**8,075**	**216,936**

Source: Authors' calculation

Table 14. The economic flow of investments (in EUR)

No	Description	Years										
		0	1	2	3	4	5	6	7	8	9	10
Scenario 1												
I	**Total inflow**	**0**	**31,782**	**32,294**	**32,849**	**33,434**	**34,052**	**34,655**	**35,268**	**35,893**	**36,528**	**250,532**
1	Total revenue	0	31,782	32,294	32,849	33,434	34,052	34,655	35,268	35,893	36,528	37,175
2	Residual value											213,358
2.1	Fixed assets											200,000
2.2	Working capital											13,358
II	**Total outflow**	**213,358**	**15,665**	**15,961**	**16,282**	**16,618**	**16,974**	**17,324**	**17,682**	**18,047**	**18,420**	**18,801**
1	Value of investment	213,358										
1.1	Fixed assets	200,000										
1.2	Working capital	13,358										
2	Material costs	0	8,458	8,595	8,742	8,898	9,063	9,223	9,386	9,552	9,721	9,894
3	Immat. costs without interest	0	4,899	4,978	5,064	5,154	5,249	5,342	5,437	5,533	5,631	5,730
4	Income tax (15%)	0	2,308	2,389	2,476	2,567	2,663	2,759	2,859	2,961	3,067	3,177
III	**Net income (I-II)**	**-213,358**	**16,117**	**16,332**	**16,568**	**16,815**	**17,078**	**17,331**	**17,587**	**17,846**	**18,108**	**231,731**
Scenario 2												
I	**Total inflow**	**0**	**24,984**	**25,386**	**25,823**	**26,282**	**26,768**	**27,242**	**27,724**	**28,215**	**28,715**	**237,853**
1	Total revenue	0	24,984	25,386	25,823	26,282	26,768	27,242	27,724	28,215	28,715	29,223
2	Residual value											208,630
2.1	Fixed assets											200,000
2.2	Working capital											8,630
II	**Total outflow**	**208,630**	**10,637**	**10,851**	**11,083**	**11,326**	**11,583**	**11,836**	**12,095**	**12,360**	**12,632**	**12,909**
1	Value of investment	208,630										
1.1	Fixed assets	200,000										
1.2	Working capital	8,630										
2	Material costs	0	3,666	3,725	3,789	3,856	3,927	3,997	4,068	4,140	4,213	4,288
3	Immat. cost without interest	0	4,964	5,044	5,131	5,222	5,319	5,413	5,509	5,606	5,706	5,807
4	Income tax (15%)	0	2,007	2,082	2,163	2,247	2,336	2,426	2,519	2,614	2,713	2,815
III	**Net inflow (I-II)**	**-208,630**	**14,347**	**14,535**	**14,740**	**14,956**	**15,186**	**15,406**	**15,629**	**15,855**	**16,083**	**224,944**

Source: Authors' calculation

The dynamic methods of assessment of investment's acceptability require that all net inflows/outflows that come from the different periods of investment are brought to the present moment based on discounting technique. The appropriate discount rate is the weighted average cost of capital, as it was already determined. *Table 15* shows the results of net present value, profitability index, and internal rate of return for both scenarios.

Table 15. Net present value, profitability index, and internal rate of return

Scenario 1			
Year	**Net inflows (EUR)**	**Discount factor**	**Present value (EUR)**
0	-213,358	1.0000	-213,358
1	16,117	0.9350	15,070
2	16,332	0.8743	14,279
3	16,568	0.8175	13,544
4	16,815	0.7644	12,853
5	17,078	0.7147	12,206
6	17,331	0.6683	11,582
7	17,587	0.6249	10,989
8	17,846	0.5843	10,427
9	18,108	0.5463	9,893
10	231,731	0.5108	118,373
Present value of net inflows (for years from 1 to 10)			229,216
Net present value (NSV)			**15,858**
Profitability index (IP)			**1.07**
Internal rate of return (IRR)			**7.99%**
Scenario 2			
Year	**Net inflows (EUR)**	**Discount factor**	**Present value (EUR)**
0	-208,630	1.0000	-208,630
1	14,347	0.9350	13,415
2	14,535	0.8743	12,707
3	14,740	0.8175	12,050
4	14,956	0.7644	11,432
5	15,186	0.7147	10,853
6	15,406	0.6683	10,296
7	15,629	0.6249	9,766
8	15,855	0.5843	9,263
9	16,083	0.5463	8,786
10	224,944	0.5108	114,905
Present value of net inflows (for years from 1 to 10)			213,474
Net present value (NSV)			**4,844**
Profitability index (IP)			**1.02**
Internal rate of return (IRR)			**7.28%**

Source: Authors' calculation

All presented results indicate that the company can consider both investments economically justified. However, higher values of examined indicators favor the investment in 10 ha of arable land and corn cultivation.

Table 16 presents the results of the sensitivity analysis. It is performed because of the instability of the markets from the beginning of 2022. Obtained results show that investment in 10 ha of land, and corn cultivation should be implemented because this investment is acceptable according to all considered cases. However, this investment was more sensitive in case of a decrease in selling price or a decrease in the yield of 5 percent. The investment was less sensitive to an increase in both material, and immaterial costs. Based on the sensitivity analysis, the first scenario is acceptable in all three parameters of investment efficiency.

Table 16. The sensitivity analysis

Scenario 1				
Parameter	**Change in parameter (%)**	**Net present value (EUR)**	**Profitability index**	**Internal rate of return (%)**
Base value	**0**	**15,858**	**1.07**	**7.99**
Selling price	+5	26,050	1.12	8.67
Selling price	-5	5,666	1.03	7.32
Yields	+5	26,050	1.12	8.67
Yields	-5	5,666	1.12	7.32
Material costs	+5	13,146	1.06	7.82
Material costs	+10	10,433	1.05	7.64
Total costs (mat.+ imm.)	+5	11,575	1.05	7.71
Total costs (mat.+ imm.) +5	+10	7,291	1.03	7.43
Scenario 2				
Parameter	**Change in parameter (%)**	**Net present value (EUR)**	**Profitability index**	**Internal rate of return (%)**
Base value	**0**	**4,844**	**1.02**	**7.28**
Selling price	+5	12,856	1.06	7.82
Selling price	-5	-3,168	0.98	6.73
Yields	+5	12,856	1.06	7.82
Yields	-5	-3,168	0.98	6.73
Material costs	+5	3,669	1.02	7.20
Material costs	+10	2,493	1.01	7.12
Total costs (mat.+ imm.)	+5	2,077	1.01	7.09
Total costs (mat.+ imm.)	+10	-691	1.00	6.90

Source: Authors' calculation

On the other hand, investment in 10 ha of land, and cultivation of soybean was more sensitive to changes in business conditions, due to lower profitability. Obtained results indicate that the second scenario should be implemented in all examined cases except in the case of a decrease in the selling price or decrease in the yield of soybean that

amounts to 5 percent. Also, in case of an increase in material, and immaterial costs (without interest) of 10 percent, the second scenario shouldn't be accepted according to the sensitivity analysis.

Discussion

Based on the results of the analysis of two potential investment alternatives, the authors can emphasize the following points:

- The first scenario - investment in 10 ha of land and cultivation of corn gives a positive net present value that amounts to 15,858 EUR, based on the economic life of the project of 10 years, and the discount rate of 6.95 percent. The second scenario - investment in 10 ha and cultivation of soybean, also indicates a positive, but lower net present value that amounts to 4,844 EUR, based on the economic life of the project of 10 years, and the discount rate of 6.95 percent. Since the net present value of both investments is higher than zero, the potential investments should be accepted. However, the first scenario investment is preferable, since the first scenario has a higher net present value than the second one.
- According to the first scenario, given the project's economic life of 10 years, and the discount rate of 6.95 percent, the profitability index is 1.07, which indicates that each EUR of the present value of investment results in 1.07 EUR of the present value of net inflows. Given the project's economic life of 10 years, and the discount rate of 6.95 percent, the second scenario has a profitability index value of 1.02, which indicates that each EUR of the present value of investment results in 1.02 EUR of the present value of net inflows. Both investments have profitability ratios higher than one, and thus, they should be accepted. However, the first alternative is more attractive than the second one, because it has a higher value of the profitability index.
- The first possibility has an internal rate of return that amounts to 7.99 percent, while the second investment has an internal rate of return of 7.29 percent. Internal rates of return of both scenarios are above the weighted average cost of capital 6.95 percent, and therefore according to this method, two projects should be accepted. The first scenario has higher profitability compared to the second one since it has a higher level of internal rate of return.
- The results of sensitivity analysis and changes of input parameters indicate that the first scenario is more acceptable in all three parameters of investment efficiency.
- All results indicate that the investigated company can consider both investments economically justified. However, higher values of examined indicators favor the investment in 10 ha of arable land and corn cultivation.

Presented results of dynamic efficiency analysis of two alternative investments are useful to the management of company X in the area of Stara Pazova in order to increase production scale and companies profitability. Also, this methodology and research example is significant to a broad range of agricultural manufacturers, investors, and

researchers interested in this area. This research could lead to new analyses of investment efficiency evaluation in agricultural production of different crops or implementation of new technology. Obtained results are in line with the results of Njegić et al., (2011), which showed that the investment in soybean cultivation (without investment in land) has a positive net inflows of the economic flow in all years of the project except in the year of implementation of the investment with positive net present value, profitability index above one, and internal rate of return above the cost of capital. Also, obtained results for two assessed scenarios are similar to the Влаовић Беговић et al., (2018) that considered the acceptability of investment in agricultural land, and production of a combination of several crops with the conclusion that the project is acceptable (according to net present value, profitability index, and internal rate of return) and contributes to the increase of enterprise value.

Conclusions

The dynamic efficiency analysis and evaluation of an investment in 10 ha of arable land, and cultivation of corn (scenario 1) or soybean (scenario 2) were performed based on the data collected by interview with the management of the company "X" and internet sources. The assessment of the acceptability of two proposed scenarios was performed using the dynamic capital budgeting methods (net present value, profitability index, and internal rate of return), as well as sensitivity analysis, which is appropriate in conditions of uncertainty.

Results of the analysis showed that investing in both observed scenarios is economically profitable and sound. However, dynamic capital budgeting methods gave advantage to the first scenario, that is, investment into 10 ha of land, and cultivation of corn. Also, sensitivity analysis showed that the corn production is less sensitive to changes and acceptable in all considered cases.

This analysis can be extended to the assessment of investment in land, and cultivation of some other types of crops, as well as in purchasing of agricultural mechanization or implementing new generation technology ("smart agriculture"). This research and efficiency evaluation example is useful to a broad range of agricultural companies, individual households, investors, and researchers.

Acknowledgements

This paper is a part of project research "Economic efficiency assessment of investments in agricultural production of corn and soybean" conducted for the private enterprise X.

Conflict of interest

The authors declare no conflict of interest.

References

1. Andres, P., Fuente, G., & San Martin, P. (2015). Capital budgeting practices in Spain. *Business Research Quarterly*, 18(1), 37-56.
2. Baruwa, I.O., & Fabode, O.A., (2019). Uporedna investiciona analiza za male proizvođače brojlera i jaja u državi Osun, Nigerija. *Journal of Agricultural Sciences*, 64(3), 279-291.
3. CFA Institute, (2020). *Corporate Finance and Equity*. Level I, Volume 4. New Jersey: Wiley Global Finance.
4. Correia, C. (2012). Capital budgeting practices in South Africa: A review. *South African Journal of Economics and Management.*
5. Damodaran, A. (2005). *Korporativne finansije: Teorija i praksa.* Modus, Podgorica. [*in English*: Damodaran, A. (2005). *Corporate finance: Theory and practice*. Modus, Podgorica].
6. Damodaran, A. (2015). *Applied Corporate Finance (4th Ed.).* Hoboken, NJ: John Wiley & Sons Inc.
7. Damodaran, A., (2022). The equity risk premium for the German market; Unlevered beta for emerging markets for agriculture, (available at: https://pages.stern.nyu.edu/~adamodar/).
8. Dašić, D., Stanić, T., & Živković, D. (2022). Market of Agricultural and Food Products in the Republic of Serbia: Possibilities and Implications. *Economics of Agriculture*, 69(1), 57-74, DOI: 10.5937/ekoPolj2201057D.
9. Dedi, L., & Orsag, S., (2007). Capital budgeting practices: A survey of Croatian firms. *South East European Journal of Economics and Business*, 2(1), 59-67.
10. Ercegovac, D., & Živkov D. (2018). Competitiveness of the Serbian economy, FDI and balance of trade deficit problem. *International Scientific and Expert Conference Economic Development and Competitiveness of European Countries,* Novi Sad School of Business, Novi Sad, October, 49-51.
11. Graham, J.R., & Harvey, C.R. (2001). The theory and practice of corporate finance: Evidence from the field. *Journal of Financial Economics*, 60(2-3), 187-243.
12. Kuzman, B., Djuric, K., Mitrović, Lj., & Prodanovic, R. (2017). Agricultural Budget and Agriculture Development in Republic of Serbia. *Economics of Agriculture,* 64(2), 515-531.
13. Lopes Santos, D.F., de Morales Farinelli, J.B., Horita, K., da Silva, B.L., & Fonseca Souza, C.A. (2020). Investment analysis of soybean production system in sugarcrane renewal areas. *Custos e @gronegocio on line*, 16(3), 130-164.
14. Marković, M., Krstić, B., & Popović, S. (2022). Competitiveness of Agri-Food Exports of the Republic of Serbia in the Covid-19 Conditions. *Economics of Agriculture*, 69(1), 227-239, DOI: 10.5937/ekoPolj2201227M.
15. Mihailović, B., Cvijanović, D., & Kuzman, B. (2014). *Challenges of Management Consulting in Modern Business of Agricultural Enterprise*, (Monograph), Institute of Agricultural Economics, Belgrade.

16. Момчиловић, М, & Ерцеговац, Д. (2022). Анализа, моделирање и мерење ризика инвестиционих пројеката у Републици Србији, *Научно-стручна конференција „ЕУ за младе – изазови и могућности“,* Висока пословна школа струковних студија, Нови Сад, мај, 35. [*in English*: Momčilović, M. & Ercegovac, D. (2022). Analysis, modeling and measuring of investment projects risks in the Republic of Serba, *Scientific conference „EU for jouth – chalanges and possibilities“,* Novi Sad School of Business, Novi Sad, May, 35].
17. Novković, N., Vukelić, N., Mutavdžić, B., Lukač-Bulatović, M., & Milošević, M. (2017). Ekonomski efekti investiranja u zasad lešnika. *Agroekonomika*, 46(74), 21-29.
18. NS COMEX – Produktna berza ad Novi Sad, (2022). Prices and yields of corn and soybean, (available at: https://nscomex.com).
19. Njegić, J., Momčilović, M., & Berber, N. (2011). The Advantages of Investing in Organic Compared to Conventional Agricultural Production, *4th International Conference for Enterpreneurship, Innovation and Regional Development – ICEIRD*, Ohrid, 1277-1284.
20. Pantić, N., Mikulič, K., & Lekovič, M. (2022). The influence of claims payments on the investment portfolio of insurance companies. *Oditor*, *8*(3), 42-71. https://doi.org/10.5937/Oditor2203042P
21. Pavlović, M. M., Popović, J., & Turnjanin, D. (2021). Development of small and medium enterprises in Serbia. *Oditor, 7*(2), 47-64. https://doi.org/10.5937/Oditor2102047P
22. Peterson, P.P., & Fabozzi, F. J. (2002). *Capital Budgeting: Theory and Practice*. New York: John Wiley & Sons.
23. Radić, V., Radić, N., & Cogoljević, V. (2022). New Technologies as a Driver of Change in the Agricultural Sector. *Economics of Agriculture,* 69(1), 147-162, DOI: 10.5937/ekoPolj2201147R.
24. Stančić, P., & Čupić, M. (2020). *Korporativne finansije*. Ekonomski fakultet Kragujevac. [*in English*: Stančić, P., & Čupić, M. (2020). *Corporate finance*. Faculty of Economics Kragujevac].
25. Statista, (2022). Inflation in EU,(available at: https://statista.com/statistics/37520).
26. Subić, J. (2017). Assessment of Investments by the Use of Software Application for Development of the Business Plan in Agriculture. *Ekonomika, 63*(2), 1-14, DOI: 10.5937/ekonomika1702001S.
27. Subić, J., Kljajić, N., & Jeločnik, M. (2017). Renewable Energy Use in Raspberry Production. *Economics of Agriculture, 64*(2), 821-843.
28. Tešić, R., Mihajlović, M., Jeremić, D., & Ilić, Đ. (2021). Strategija diverzifikacije kao nužnost opstanka, rasta i razvoja proizvodnih preduzeća, *Akcionarstvo, 27*(1), 27-39.
29. Todorovic, M., Kalicanin, Dj., & Nojkovic, A. (2015). Practices of Performance Measurement in Companies in the Republic Of Serbia. *Economic Horizons, 17*(1), 45-58, DOI: 10.5937/ekonhor1501045T.

30. Todorović, M., & Ivanišević, M. (2018). *Poslovne finansije.* Beograd: Centar za izdavačku delatnost Ekonomskog fakulteta u Beogradu.
31. Trading Economics, (2022). Yield on the German 10-year government-owned bond, (available at: https://tradingeconomics.com/germany/government-bond-yield).
32. Влаовић Беговић, С., Момчиловић, М., & Томашевић, С. (2018). Оцена економске ефикасности инвестиција. *Анали Економског факултета у Суботици*, 54(39), 187-204. [*in English*: Vlaović Begović, S., Momčilović, M., & Tomašević, S. (2018). Economic efficiency assessment of investment. *Annals of Economic faculty in Subotica*, 54(39), 187-204].

CONSUMER ATTITUDES AND HABITS ABOUT PRODUCTS WITH GEOGRAPHICAL INDICATION IN SERBIA

Miloš Ćirić[1], Ivana Ćirić [2], Tatjana Pivac[3], Snežana Besermenji [4]

**Corresponding author E-mail: milos.ciric.gastronom@gmail.com*

ARTICLE INFO

Original Article

Received: *30 June 2022*

Accepted: *15 September 2022*

doi:10.59267/ekoPolj230181C

UDC 658.893:338.439.22(497.11)

Keywords:

GI, attitudes, habits, consumers, Serbia.

***JEL**: L15, Q13, Q18*

ABSTRACT

To market products with geographical indications in the best possible way, it is necessary to examine the attitudes and habits of consumers. The subject of this paper is a survey on habits and attitudes of consumers about products with GI in Serbia. The aim of this paper is to examine the level of familiarity, attitudes, and habits of consumers, as well as to determine the knowledge and interest in these products. Citizens of Serbia participated in the research (n = 399). The methodology is based on a questionnaire that obtained the data that were processed via t-test statistical methods for independent samples, one-factor analysis of variance, the χ^2 test, and Pearson's correlation coefficient. Based on the conducted research, it can be stated that about 70% of respondents are willing to pay a higher price for these products.

Introduction

The protection system of products with GI (Geographical Indication) was created in order to follow the development and the need to offer and highlight unique agricultural, food and gastronomic products. In this way, GI has had positive effects on consumers of services or products, creating a clear picture of the specific, authentic characteristics of food and beverages. Their constant production and sales has had a positive impact

1 Miloš Ćirić, MSc, Teacher, Academy of Vocational Studies Belgrade, Department of Hotel Management School, Kneza Višeslava 70, 11000 Belgrade, Serbia, E-mail: milos.ciric.gastronom@gmail.com, ORCID ID (https://orcid.org/0000-0003-4182-448X)

2 Ivana Ćirić, MSc, Teacher, High School of Tourism New Belgrade, Otona Zupancica 4, 11000 Belgrade, Serbia, E-mail: jankovic.ivanaaa@gmail.com, ORCID ID (https://orcid.org/0000-0002-4758-5160)

3 Tatjana Pivac, Ph.D., Full Professor, Department of Geography, Tourism and Hotel Management, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, Phone: +381 21 48 52 835, E-mail: tatjana.pivac@dgt.uns.ac.rs, ORCID ID (https://orcid.org/0000-0002-1660-1295)

4 Snežana Besermenji, Ph.D., Full Professor, Department of Geography, Tourism and Hotel Management, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovića 3, 21000 Novi Sad, Serbia, Phone: +381 21 48 52 836, E-mail: snezana.besermenji@dgt.uns.ac.rs,

on economic development of the country - the region from which the products originate (Ćirić et al., 2020), helping thus the process of nurturing tradition, aspiring tourist potential and preserving regional and national image (Lukinović et al., 2021). These quality schemes have been developed to protect producers and consumers from similar products that may be found on the market (Balogh et al., 2016). Geographical indications refer to products with specific characteristics, quality or reputation that derive from their geographical origin. Geographical indications are intellectual property, which is regulated by international policies and regulations (Vandecandelaere et al., 2020).

Geographical indications are especially important for less developed countries, because most of their exports are these products, with Slovenia being the best example of placement and use of protected products (Kalenjuk et al., 2010). The geographical indication shows the locality from which the labelled product originates, it provides these consumers with information from which country, region and place it originates, but also, due to originating from that locality, the product has specific properties, as a result of natural factors, skills of people from that geographical area or a combination of the two (Tešanović, Koprivica, 2007).

Products that have a geographical indication have a developed market both in Europe and the rest of the world. Research within the European Community has shown that an increasing number of consumers when buying food opt for products that bear a geographical indication, although such products fetch a higher price than conventional ones. Also, research conducted by Užar et al. (2022) showed that consumers who value quality of the products perceive GI as a confirmation of its quality and means of support to local producers. Examples from the EU countries show that a properly established system of GI inevitably brings huge economic benefits - this approach to ensuring the quality and brand of food products ensures the development of the region; it drives the economy, and above all, tourism in a certain region, especially rural areas (Savić, Đurić, 2008). From the aspect of healthy nutrition and a healthy natural environment, it can be said that tourism is vitally dependent on agriculture, although, on the other hand, it directly or indirectly encourages the prosperity of agriculture and the economy of a country (Vujović, 2007).

Producers mostly look at the economic side of this production, which is most often an excuse for its current realisation (Červenski et al., 2020). Several consumer studies have confirmed these two perspectives, shedding light on the fact that local food products can be seen as a way to support and protect the local agricultural economy (Onozaka et al., 2010), as well as a way to preserve the environment (Aprile et al., 2016). Agriculture is one of the few economic activities in Serbia that has been continuously recording a positive foreign trade balance for many years (Kovačević et al., 2020).

Literature Review

The origin of food and the transparency of the food chain are also of interest to consumers due to the growing awareness of environmental and health concerns

(Skallerud, Wien, 2019). At the moment, the food sector is considered one of the most important in the global economy, which is certainly shown by FAO data, where the value of food production increased by 8% in the period 2007-2017, which amounts to 2.3 billion dollars, but we should not ignore the fact that the food sector and food industry continue to face many challenges in product management (Horvat et al., 2019; Pinna et al., 2017; Ryynänen, Hakatie, 2014).

Primary production and adequate distribution of products as products with GI attract great attention as a very important factor influencing consumer behaviour, in addition, this type of protection requires high quality products aimed at protection from unfair competition (Katerinopoulou et al., 2020).

Authors Ćirić et al. (2020) state that products with GI represent a system for the preservation of national identity and are extremely important for the authentic offer of gastro tourism. In this sense, gastronomic tourism is therefore based on the concept of knowledge and learning, consuming and enjoying the gastronomic culture that identifies with the territory (Fusté-Forné, 2020) which means that food tourism represents visits to food producers, food fairs and gastro festivals, events, markets or other forms of tourism based on food activities.

Geographical indication PDO, PGI, TSG represent an abbreviated name of products that originate from certain regions and follow the traditional production process, the European Union has defined four geographical indications, which differ from each other:

- Protected Designation of Origin (PDO), includes agricultural, food products and wines related to the products of a certain geographical area, considering that all segments of production, preparation and processing are performed in the same geographical area,

- Protected Geographical Indication (PGI), covers agricultural, food products and wines that are closely related to the geographical area, while at least one of the stages of production, processing or preparation takes place in this area, while in wine 85% of the grapes must be from that geographical climate,

- Traditional Specialty Guaranteed (TSG) covers food and agricultural products, this label indicates the traditional aspects of the product in the way it is made or its composition by linking it to a certain geographical area, protecting it from counterfeiting and misuse,

- Geographical indication of spirit drinks and aromatized wines (GI), protects the name of an alcoholic beverage or aromatized wine originating in a country, region or locality where the special quality, reputation or other characteristics of the product's core can be attributed to its geographical origin (European Commision 2023).

Table 1. Number of registered PDO, PGI, TSC, GI products

		PDO	PGI	TSC	GI
Applied	Food	78	101	7	-
	Wine	71	27	-	-
	Spirit drinks	-	-	-	14
Published	Food	16	25	1	-
	Wine	6	1	-	-
	Spirit drinks	-	-	-	1
Registered	Food	681	928	63	-
	Wine	1184	445	-	-
	Spirit drinks	-	-	-	259
Rejected	Food	-	3	0	-
	Wine	-	1	-	-
	Spirit drinks	-	-	-	-
Cancelled	Food	-	4	-	-
	Wine	2	-	-	-
	Spirit drinks	-	-	-	-

Source: EU DOOR database 2023

Based on EU data for 2023, shown in Table 1, a total of 1856 PDO products have been registered, 681 of which belong to the category of food and agriculture, while the remaining 1184 products belong to the category of wine. When it comes to TSG products, there are only 63 of them. Alcoholic beverages (GI) amount to 259 products. The largest number of registered PDO, PGI, TSG and GI products in 2023 can be found in Italy (880), followed by France with (753), Spain (349), Greece (277), Portugal (196), Germany (176), and the UK (83). When it comes to the surrounding area of Serbia, Croatia has 63 products, Hungary has 84 protected products, and Romania has 72 products with a designation of origin. Bulgaria has 75 products with a designation of origin. This number is often not correlated with the financial value of production and trade of PDO and PGI products, exercised by a Member State. For example, Portugal has a large number of products in the European register, given the fact that they are mostly low-value products (fruits and vegetables), this country has a very small financial turnover on a European scale. In contrast, Germany and the UK account for over 30% of total European turnover with a relatively small number of registered products (EU DOOR database, 2023).

There are multiple correlations between sustainability and geographical indications, products with geographical protection of origin can be considered as drivers of sustainable and rural development (Chilla et al., 2020). In particular, food tourism refers to the discovery of culture through food (Long, 2004). In this sense, gastronomic tourism is therefore based on the concept of knowledge and learning, consuming and enjoying a gastronomic culture that identifies with the territory (Fusté-Forné, 2020). Intellectual property rights have gained in value only in the last few years (Zarić et al., 2012). However, as the main shortcoming of the Law on Indications of Geographical Origin (Official Gazette 44/2018), authors should point out the fact

that Traditional Specialty Guaranteed (TSG) is not defined according to European legislation (Simović, 2015). As another inconsistency, two institutions participate in the process of registering geographical indications - Ministry of Agriculture, Forestry and Water Management of the Republic of Serbia and Intellectual Property Office of the Republic of Serbia (Kovačević et al., 2022). According to the Intellectual Property Office in 2022, this list in Serbia includes 67 domestic products with a protected name of origin or geographical origin, which are registered in the name of domestic persons, which certainly represents a small number according to the potential. By inspecting the website of the Institute for Intellectual Property (www.zis.gov.rs), it can be concluded that most of the listed products do not have active authorised users, i.e. 22 products do not have specified authorised users, which clearly shows that the geographic indication registration process is very demanding and insufficiently recognizable on the market. Of the total number of protected products in the world, 85% of products are related to agri-food products (Simin et al., 2016).

Materials and Methods

In the research, 399 respondents participated, and over the course of March 2021, a questionnaire was distributed via social media (Facebook groups) in a free sample to the citizens of the Republic of Serbia. The questionnaire, which was used for the research, was taken over and modified based on the research Teuber, 2011 and Dragin et al., 2018. Before filling in the questionnaire, the respondents were introduced to the goal of the research, as well as the way of marking the selected answers. SPSS 20.0 was used for data processing. The results are presented graphically and tabularly. In order to determine the differences between the respondents by gender, in terms of attitudes about products with geographical indication, a t-test for independent samples was used. In order to compare the respondents by age and level of education in terms of attitudes about products with geographical indication, a one-factor analysis of variance was used. In order to examine the relationship between the sociodemographic characteristics of the respondents and the questions from the questionnaire originating from the nominal or ordinal measurement scale, the χ^2 test was applied. Pearson's correlation coefficient was used to determine the relationship between age and frequency of product consumption on the one hand and self-assessment of product knowledge on the other.

Results and Discussion

Analysis of Socio-Demographic Characteristics of Respondents

Looking into Table 2, it is observed that one third of the respondents are male, while twice as many are female. Observed by age, there's a uniform number of respondents by groups. Namely, about 25% of respondents are in the following categories: up to 25 years, from 36 to 45 years, as well as over 45 years. Slightly fewer respondents, 21% are between 26 and 35 years old. The average age of the respondents is 37 years. Regarding the last obtained level of formal education, it can be said that there is a fairly balanced

percentage of respondents with High School (35%), College and University 33% and a degree in Specialized, Bachelor's Studies, Master's Degree or Doctorate 30%. The number of respondents who have only completed Primary School is negligible.

Table 2. Socio-Demographic Characteristics of the Respondents

Question	Claims	Value (n)	Share (%)
Gender	Male	129	32.30
	Female	270	67.70
Age range	Aged till 25	104	26.10
	Aged from 26 to 35	84	21.10
	Aged from 36 to 45	102	25.60
	Aged over 45	102	25.60
	Without answer	7	1.80
Degree of education	Primary school	8	2
	High School	141	35.30
	College or Faculty	132	33.10
	Specialized Academic Studies, Bachelor's Degree, Master's Degree, Doctorate	118	29.60

Source: Author's Research

The largest percentage of respondents are those who are Employed 63%, while 18% are Pupils/Students and about 13% are Unemployed. There are 4% of the Retired who participated in the research, and about 2% of Housewives. Observed by type of settlement, the sample is dominated by respondents who live in Cities about 80%, while every fifth respondent lives in the Countryside. Half of the respondents live in the Capital, and every fourth is a resident of Vojvodina. 7% of respondents come from Sumadija and Southern Serbia respectively, and about 5% of them are from Western Serbia. The smallest number of respondents is from Eastern Serbia 3% and from Kosovo and Metohija 0.5%. Regarding the economic status and considering the average income at the national level, it can be said that almost two thirds of the respondents estimate that they live in a household that can be qualified as a household of moderately satisfactory economic status. Every fourth respondent thinks that the material condition of their household is more modest, and every tenth thinks that they have a high economic status (Table 3).

Table 3. Workplace, Population, Region of Living, Material Status of the Respondents

Question	Claims	Value (n)	Share (%)
Representation of the Sample Structure by Employment Status	Unemployed	51	12.80
	Employed	252	63.20
	Retired	16	4
	Housewife	7	1.8
	Pupil/Student	73	18.30
Representation of the Sample Structure by the Type of Settlement	Countryside	84	21.10
	City	315	78.90
Representation of the Sample Structure by Region	Vojvodina	103	25.80
	Belgrade	203	50.90
	Sumadija	28	7
	Western Serbia	22	5.5
	Eastern Serbia	12	3
	Southern Serbia	29	7.3
	Kosovo and Metohija	2	0.5
Representation of the Sample Structure by the Economic Status of Households	Household of More Modest Economic Status	104	26.10
	Household of Medium Satisfactory Economic Status	257	64.40
	Household of High Economic Status	38	9.50

Source: Author's Research

Descriptive Statistics

Respondents were able to express their views on products with protected geographical origin. They had 19 statements in front of them and answered by choosing one of the offered answers on the scale (I completely disagree, I disagree, I am not sure, I agree, I mostly agree).

Table 4. Distribution of respondents' responses to claims about products with a protected geographical area

Claims	AS	SD
By purchasing products with geographical indications, support is given to small producers	4.38	0.93
The purchase of products with geographical indications provides support to the local economy	4.41	0.90
I am willing to pay a higher price for products with geographical indications	3.92	1.12
Products with a geographical indications become recognizable due to a direct link with a certain geographical area, which gives them a special value	4.41	0.90
Products with geographical indications are custodians of cultural heritage	4.46	0.86

Claims	AS	SD
Products with a geographical indication achieve a better position on the domestic market	3.72	1.06
Products with a geographical indication achieve a better position on the international market	4.10	0.99
I believe that the awareness of the need to protect geographical indications is not sufficiently developed in our country	4.48	0.95
I believe that the promotion of products with a geographical indication contributes to the development of tourism	4.58	0.79

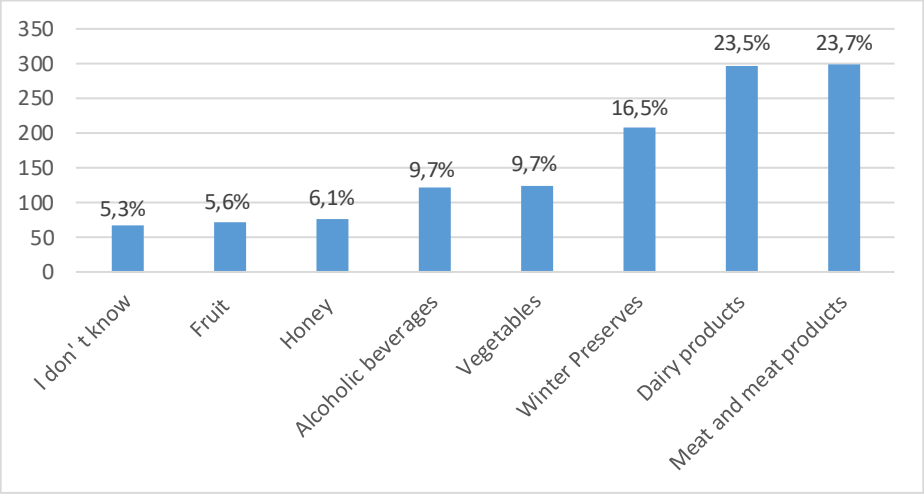
Source: Author's Research

Note: AS-arithmetic mean, SD-standard deviation

It can be stated that respondents express the highest degree of agreement (summarised categories I agree and mostly agree) with the statement "I believe that the promotion of products with a geographical indication contributes to the development of tourism", because this attitude is represented by 90% of them. Large % matches the claims that our country is not sufficiently developed in its awareness about the importance of geographical indication, that these products are custodians of cultural heritage, that they have special value due to connection with a specific geographical area, but also that their purchase supports small producers and the local economy. Respondents have a somewhat more reserved view of the claim that products with a geographical indication achieve a better position in the international market, although most of them agree, 17% of them are not sure that this is the case. Willing to pay a higher price for products with geographical indication, 18% are not sure of their position on this item reading, while every tenth respondent expresses disagreement with the statement. Respondents have a relatively divided opinion regarding the claim that products with a geographical indication achieve a better position in the domestic market, so about 60% of them express agreement, in whole or in part, while 30% of respondents are unsure of their position on this topic, and 10% do not agree with the statement (Table 4).

Respondents had the opportunity to list three domestic products that they know have a geographical indication. Almost all of them answered the question (only 10 out of 399 respondents did not give an answer), by mentioning one or more products. Most respondents mentioned: ajvar (163), Pirot sausage (82), Sjenica cheese (71), raspberry from Arilje (62) and Futog cabbage (59), honey (77). A total of 1264 responses were collected, grouped by product type. Graph 1 shows the responses of respondents categorised according to different product groups (Figure 1).

Figure 1. Overview of product categories with geographical indication according to the respondents



Source: Author's Research

It can be noticed that the respondents mostly mentioned meat products, but also dairy products, as products with geographical indication. In addition to them, a large share has products that can be classified as winter products, and a slightly smaller share has vegetables, alcoholic beverages, honey and fruits. About 5% of respondents answered that they do not know which products have a geographical indication. Some respondents listed specific products, but there were also those who listed a specific product category. There are a total of 299 answers related to meat products. Of the products belonging to vegetables, 123 responses were given, while a total of 122 responses are related to alcoholic beverages. Honey was listed as a food item 77 times, while a total of 71 responses concerned fruit (Chart 1).

Table 5. Distribution of respondents' responses to claims about products with geographical indication

Question	Claims	Value (n)	Share (%)
„ Assess your knowledge of protected geographical indications from 1 to 5, with 1 being the lowest and 5 the highest."	1	27	6.80
	2	84	21.10
	3	165	41.40
	4	81	20.30
	5	42	10.50
"I am interested in learning more about the subject of products with geographical indication."	Yes	337	84.50
	No	62	15.50

Question	Claims	Value (n)	Share (%)
"Do you think that the placement of products with geographical indication helps the development of the local economy and the region?"	I completely disagree	4	1
	I disagree	8	2
	I am not sure	13	3.30
	I agree	102	25.60
	I mostly agree	272	68.20
"Adequate placement of products with geographical indication on the catering market resulted in higher quality food in restaurants.	I completely disagree	6	1.50
	I disagree	10	2.50
	I am not sure	47	11.80
	I agree	132	33.10
	I mostly agree	204	51.10

Source: Author's Research

By looking at Table 5, a normal distribution of results can be observed. Namely, most of the respondents 41% rated themselves with a medium grade, while about 20% of them gave themselves a grade of 2 or 4. Every tenth respondent thinks that he deserves the highest grade for his/her knowledge of products with geographical indication, while 7% of respondents rate themselves with the lowest grade. It can be stated that only 30% of respondents assess themselves as individuals who have relevant knowledge about this type of products, and that it is necessary to implement appropriate strategies and plans to make the population more familiar with products bearing the protected geographical indication, their characteristics and significance. Many respondents, 85%, express interest in getting more fully acquainted with the topic of products with protected geographical indication, which is not surprising, given the answers to the previous question. Half of the respondents express complete agreement, and a third claim that they agree that the placement of products with geographical indication helps the development of the local economy and the region. About 12% of respondents are unsure of their position on this issue, while 4% disagree. Respondents mostly agree that adequate placement of products with geographical indication on the catering market results in higher quality food in restaurants - about 70% express complete agreement, and 25% agree.

Table 6. Comparison of respondents by gender in terms of attitudes about products with geographical indication

Claims	Pol	N	M	SD	T	P
By purchasing products with geographical indication, support is given to small producers	male	129	4.2	1.1	-2.16	.031*
	female	270	4.5	0.9		
Products with geographical indication are custodians of cultural heritage	male	129	4.3	1.0	-2.05	.042*
	female	270	4.5	0.8		

Source: Author's Research

Note: N - number of respondents, M - arithmetic mean, SD - standard deviation, t - statistics, p - statistical significance; ** significance at level 0.01.; * significance at the level of 0.05.

The results of the t-test of independent samples show that there are statistically significant differences regarding the statement "Purchase of products with geographical indication gives support to small producers" between men and women, (t (211.174) = -2.16, p = .031). Namely, female respondents' express agreement with the statement (AS = 4.5, SD = 0.9) to a greater extent compared to male respondents (AS = 4.2, SD = 1.1). Also, the existence of statistically significant differences was found regarding the statement "Products with geographical indication are custodians of cultural heritage" between men and women (t (207,976) = -2.05, p = .042). Namely, female respondents to a greater extent express agreement with the statement (AS = 4.5, SD = 0.8) compared to male respondents (AS = 4.3, SD = 1.0) (Table 6).

Regarding other claims, no statistically significant differences were found between male and female respondents.

Table 7. Comparison of average values on the scale of attitudes about products with geographical indication according to the age of the respondents

Claims		Sum of square	Df	Average square	F	P
By purchasing products with geographical indication, support is given to small producers	Between groups	7.074	3	2.358	2.733	.044
	Within groups	334.801	388	.863		
	In total	341.875	391			
The purchase of products with geographical indication provides support to the local economy	Between groups	6.302	3	2.101	2.614	.051
	Within groups	311.818	388	.804		
	In total	318.120	391			
I am willing to pay a higher price for products with geographical indication	Between groups	23.946	3	7.982	6.579	.000
	Within groups	470.748	388	1.213		
	In total	494.694	391			
Products with a geographical indication become recognizable due to a direct link with a certain geographical area, which gives them a special value	Between groups	4.289	3	1.430	1.777	.151
	Within groups	312.219	388	.805		
	In total	316.508	391			
Products with geographical indication are custodians of cultural heritage	Between groups	9.207	3	3.069	4.280	.005
	Within groups	278.219	388	.717		
	In total	287.426	391			
Products with a geographical indication achieve a better position on the domestic market	Between groups	16.354	3	5.451	4.983	.002
	Within groups	424.493	388	1.094		
	In total	440.847	391			
Products with a geographical indication achieve a better position on the international market	Between groups	29.294	3	9.765	10.518	.000
	Within groups	360.213	388	.928		
	In total	389.508	391			

Claims		Sum of square	Df	Average square	F	P
I believe that the awareness of the need to protect products with a geographical indication is not sufficiently developed in our country	Between groups	1.350	3	.450	.487	.691
	Within groups	358.395	388	.924		
	In total	359.745	391			
I believe that the promotion of products with a geographical indication contributes to the development of tourism	Between groups	8.313	3	2.771	4.451	.004
	Within groups	241.541	388	.623		
	In total	249.855	391			

Source: Author's Research

Note: Df - degrees of freedom, F - statistics, p - statistical significance

The results of the ANOVA test indicate that there are statistically significant differences regarding the statement "Purchasing products with geographical indication gives support to small producers between respondents of different ages." (F (3,388) = 2,733, p = .044). A follow-up test for multiple comparisons (Tuckey HSD) found that respondents over the age of 45 statistically differed significantly from those under the age of 25 in terms of expressing a higher degree of agreement with the statement compared to younger respondents. While the statement "I am ready to pay a higher price for products with geographical indication" among respondents of different ages (F (3,388) = 6,579, p <.001) just like the statement "Products with geographical indication are custodians of cultural heritage" (F (3,388) = 4,280, p = .005). A follow-up test for multiple comparisons (Tuckey HSD) found that respondents aged 35 to 45 and over 45 were statistically significantly different from those under 25 in terms of expressing a higher degree of agreement with the above statement compared to younger respondents (Table 7).

The results of the ANOVA test indicate that there are statistically significant differences regarding the statement "Products with a geographical indication achieve a better position in the domestic market" between respondents of different ages (F (3,388) = 4,983, p = .002), just as the statement "Products with a geographical indication achieve a better position in the international market "(F (3,388) = 10,518, p<.001) and "I believe that the promotion of products with a geographical indication contributes to the development of tourism ", just as is the case in previous statements (F (3,388) = 4,451, p = .004). A follow-up test for multiple comparisons (Tuckey HSD) found that respondents over 45 years of age differed statistically significantly compared to respondents up to 25 years of age in terms of expressing a higher degree of agreement with the statement compared to younger respondents, while in the second and third statements found that respondents aged 35 to 45 years and over 45 years were statistically significantly different compared to respondents younger than 25 years. Also, in the second statement, the respondents belonging to the age group of 35 to 45 years are statistically significantly different from the respondents from 26 to 35 years of age in the sense that they agree more with the statement. No statistically significant differences (p>.05) were found between

respondents of different age groups in terms of other claims concerning attitudes about products with protected geographical origin (Table 7).

Table 8. Comparison of average values on the scale of attitudes about products with geographical indication according to the level of education of the respondents

Claims		Sum of square	Df	Average square	F	P
By purchasing products with geographical indications, support is given to small producers	Between groups	1.644	2	.822	.980	.376
	Within groups	325.486	388	.839		
	In total	327.130	390			
The purchase of products with geographical indications provides support to the local economy	Between groups	4.884	2	2.442	3.159	.044
	Within groups	299.996	388	.773		
	In total	304.880	390			
I am willing to pay a higher price for products with geographical indications	Between groups	4.001	2	2.000	1.639	.195
	Within groups	473.401	388	1.220		
	In total	477.402	390			
Products with a protected geographical indications become recognizable due to a direct link with a certain geographical area, which gives them a special value	Between groups	.829	2	.414	.529	.590
	Within groups	304.220	388	.784		
	In total	305.049	390			
Products with geographical indications are custodians of cultural heritage	Between groups	.449	2	.224	.308	.735
	Within groups	282.687	388	.729		
	In total	283.136	390			
Products with a geographical indication achieve a better position on the domestic market	Between groups	*5.609*	*2*	*2.805*	*2.536*	*.080*
	Within groups	429.005	388	1.106		
	In total	434.614	390			
Products with a geographical indication achieve a better position on the international market	Between groups	1.016	2	.508	.523	.593
	Within groups	376.892	388	.971		
	In total	377.908	390			
I believe that the awareness of the need to protect products with a geographical indication is not sufficiently developed in our country	Between groups	1.315	2	.658	.737	.479
	Within groups	346.358	388	.893		
	In total	347.673	390			
I believe that the promotion of products with a geographical indication contributes to the development of tourism	Between groups	3.715	2	1.857	3.086	.047
	Within groups	233.497	388	.602		
	In total	237.212	390			

Source: Author's Research

Note: Df - degrees of freedom, F - statistics, p - statistical significance

The results of the ANOVA test indicate that there are statistically significant differences regarding the statement "Purchasing products with geographical indication gives support to the local economy", between respondents of different levels of education (F (2,388) = 3,159, p = .044), just as with the statement " I believe that the promotion of products with a geographical indications contributes to the development of tourism "among respondents of different levels of education (F (2,388) = 3,086, p = .047). A follow-up test for multiple comparisons (Tuckey HSD) found that more educated respondents (with completed specialist academic studies, master's degree, master's degree and doctorate) were statistically significantly different from respondents with completed high school in terms of greater agreement with the statement, while in the second statement, it was determined that the respondents with higher education differ statistically significantly from the respondents with completed high school and college in the sense that the most educated respondents express a more affirmative attitude regarding the stated statement in relation to the others. No statistically significant differences (p>.05) were found between respondents of different levels of education in terms of other claims concerning attitudes about products with protected geographical indications (Table 8).

Table 9. Relationship between age and self-assessment of knowledge about products with geographical indications

		Self-assessment
Age	Pearson Correlation	.116*
	Sig.	.022
	N	392

Source: Author's Research

Note: Pearson Correlation – statistics, Sig. – statistical significance, N – number of respondents

** significance at level 0.01.; * significance at the level of 0.05.

The results of Pearson's correlation indicate that there is a statistically significant positive correlation between the age of the respondents and the self-assessment of knowledge about products with protected geographical indications (r (390) = .116, p = <.05)). Although the correlation is significant, it is very low and indicates that the older the respondents, the more positively they assess their knowledge (Table 9).

Conclusion

The geographical indication system plays a very important role in the regional economy, given that such products are the drivers of the region's economy. Regarding the comparison of respondents' attitudes towards products with geographical indications, it can be said that women were more likely to believe that the purchase of these products supports small producers, as well as that products with a geographical indication are custodians of cultural heritage. Also, older respondents (over 45 years of age) differ statistically significantly and agree to a greater extent with most claims about products with geographical indications compared to the youngest category of respondents (younger than 25 years). Considering

that the claims are primarily affirmative, it can be concluded that older respondents show a higher level of understanding and evaluation of these products. When it comes to the educational structure, there are differences in terms of claims that the purchase of these products supports the local economy and contributes to the development of tourism in the sense that more educated respondents are more in line with these claims than those with lower education. When it comes to self-assessment of knowledge of respondents in relation to products with geographical indications, no connection has been established between self-assessment of knowledge and gender, i.e., education of respondents. Older respondents rate their knowledge with a slightly higher grade, as do those who more often consume products with a geographical indication.

The limiting factors are reflected in the fact that the number of male respondents is insufficiently represented, just like the number of respondents according to employment status. It should also be emphasised that the number of respondents from rural areas is insufficiently represented, as well as the uneven response of respondents in the regions of Serbia, which can certainly affect different attitudes and habits. While in terms of material status, the number of respondents is also not equal, which can completely change the perception of attitudes and habits of consumers about products with geographical indications. Therefore, as one of the recommendations for further research, it is possible to refer to the necessity of wider research, i.e., in a more correct distribution of respondents, in order to obtain more relevant data that would enable a great variety of attitudes and habits about products with geographical indications. It should also be pointed out that as a limiting factor, producers are not interested in the certification process, given that the certification process itself is expensive, and that customers do not recognize and do not want to favour products for geographical indications.

Recommendations for future research can go in the direction of examining consumers about the familiarity of which food has a GI and how many customers recognize the Serbian GIs label.

Acknowledgments

"The authors acknowledge financial support of the Ministry of Education, Science and Technological Development of the Republic of Serbia (Grant No. 451-03-68/2022-14/200125)"

Conflict of interests

The authors declare no conflict of interest.

References

1. Aprile, M. C., Caputo, V., & Nayga Jr, R. M. (2016). Consumers' preferences and attitudes toward local food products. *Journal of food products marketing*, *22*(1), 19-42. https://doi.org/10.1080/10454446.2014.949990.

2. Balogh, P., Békési, D., Gorton M., Popp, J., & Lengyel, P. (2016). Consumer willingness to pay for traditional food products. *Food Policy* 61, 176–184. https://doi.org/10.1016/j.foodpol.2016.03.005.

3. Červenski, J. F., Medić-Pap, S. S., Danojević, D. Đ., Savić, A. D., & Bugarski, D. Ž. (2020). The importance of crop rotation in Intensive vegetable production in a greenhouse. Journal of Agricultural Sciences (Belgrade), 65(3), 199-212. DOI: 10.2298/JAS2003199C.

4. Chilla, T., Fink, B., Balling, R., Reitmeier, S., & Schober, K. (2020). The EU Food Label 'Protected Geographical Indication': Economic Implications and Their Spatial Dimension. *Sustainability*, 12(14), 5503. https://doi.org/10.3390/su12145503.

5. Ćirić, M., Kalenjuk, B., & Janković, I. (2020). Regional Products With the Protection of Origin in Serbia Tourism Offer. *Indonesian Journal of Tourism and Leisure*, *1*(2), 61-72. DOI: https://doi.org/10.36256/ijtl.v1i2.101.

6. Dragin, A., Blešić, I., Pivac, T., Košić, K., & Demirović, D. (2018). Importance of connection of hospitality and local agricultural manufacturers. *Agroeconomics*. *47*(78), 73-84. [in Serbian: Dragin, A., Blešić, I., Pivac, T., Košić, K., & Demirović, D. (2018). Importance of hospitality and local producers connectivity. *Agroekonomika 47*(78), 73-84]. DOI 10.5937/skolbiz1-16287.

7. European Commission (2023). *Geographical indications and quality schemes explained.* Accessed on 29 January 2023, available at: https://agriculture.ec.europa.eu/farming/geographical-indications-and-quality-schemes/geographical-indications-and-quality-schemes-explained_en#pdo

8. European Commission (EU DOOR database, 2023). *Geographical indications register*. Accessed on 29 January 2023, available at: https://ec.europa.eu/info/food-farming-fisheries/food-safety-and-quality/certification/quality-labels/geographical-indications-register/

9. Fusté-Forné, F. (2020). Developing Cheese Tourism: A Local-based Perspective From Valle de Roncal (Navarra, Spain). *Journal of Ethnic Foods*, 7(1), 26. https://doi.org/10.1186/s42779- 020-00064-2.

10. Horvat, A., Behdani, B., Fogliano, V., & Luning, P. A. (2019). A systems approach to dynamic performance assessment in new food product development. *Trends in Food Science & Technology*, *91*, 330-338. https://doi.org/10.1016/j.tifs.2019.07.036.

11. Kalenjuk, B., Vulić, G., & Tešanović, D. (2010). Positioning of protected Slovenian gastronomic products in tourism. *Research Review of the Department of Geography, Tourism and Hotel Management, 39*, 232-247. [in Serbian: Kalenjuk, B., Vulić, G., & Tešanović, D. (2010). Pozicioniranje zaštićenih slovenačkih gastronomski proizvoda u turizmu. *Proceedings of the Department for Geography, Tourism and Hotel Management*, *39*, 232-247].

12. Katerinopoulou, K., Kontogeorgos, A., Salmas, C. E., Patakas, A., & Ladavos, A. (2020). Geographical Origin Authentication of Agri-Food Products: A Review. Foods, 9(4), 489. https://doi.org/10.3390/foods9040489.

13. Kovačević, V., Brenjo, D., Cvetković, S., & Rainović, L. (2022). Comparative analysis of foodstuff geographical indications in the Western Balkans. *Economics of Agriculture*, *69*(1), 163-178.

14. Kovačević, V., Grujić Vučkovski, B., & Tica, N. (2020). Measures to support investments in the production and processing of agricultural products on small farms: Existing legal framework and administrative conditions in the sector of processing agricultural products on the farm.In: Improving knowledge transfer to obtain safe and competitive agricultural products obtained by processing small farms in the dairy sector, meat, fruits and vegetables – book 2. Institute of Agricultural Economics, Belgrade, pp, 177-198. ISNB 978-86-6269-086-9. [*in Serbian*: Kovačević, V., Grujić Vučkovski, B., & Tica, N. (2020). Measures to support investments in the production and processing of agricultural products on small farms: Existing legal framework and administrative conditions in the sector of processing agricultural products on farms. In: Improving the transfer of knowledge in order to obtain safe and competitive agricultural products, which were obtained by processing on small farms in the milk, meat, fruit and vegetable sectors - book 2. Institute for Agricultural Economics, Belgrade, pp 177-198. ISBN 978-86-6269-086-9].

15. Long, L. M. (2004). Learning to listen to the food voice: recipes as expressions of identity and carriers of memory. *Food, Culture & Society*, *7*(1), 118-122. https://doi.org/10.2752/155280104786578067.

16. Lukinović, M. V., Opačić, A. I., & Milojević, I. M. (2021). Geographical Indications As A Means Of Valorization Of Economic Business – A Chance For Rural Recovery. Sociological Review, *55*(4), 1412-1437. [in Serbian: Lukinović, M. V., Opačić, A. I., & Milojević, I. M. (2021). Oznake geografskog porekla kao sredstvo valorizacije privrednog poslovanja – šansa za oporavak sela. Sociološki pregled *55*(4), 1412-1437].

17. Official gazette of the Republic of Serbia, Law On Marks Of Geographical Origin ("Official Gazette of RS", no. 18/2010 and 44/2018).

18. Onozaka, Y., Nurse, G., & McFadden, D. T. (2010). Local food consumers: How motivations and perceptions translate to buying behavior. Retrieved from www.choicesmagazine.org/magazine/article.php?article=109.

19. Pinna, C., Plo, L., Robin, V., Girard, P., & Terzi, S. (2017). An approach to improve implementation of PLM solution in food industry-case study of Poult Group. *International Journal of Product Lifecycle Management*, *10*(2), 151-170. https://doi.org/10.1504/IJPLM.2017.085958.

20. Ryynänen, T., & Hakatie, A. (2014). We must have the wrong consumers"–a case study on new food product development failure. *British Food Journal*. https://doi.org/10.1108/BFJ-08-2012-0215.

21. Savić, M., & Đurić, I. (2008). Geografic indications of origine of agricultural and food products. Economics of Agriculture, *55*(2), 207-218. [*in Serbian*: Savić, M., & Đurić, I. (2008). Geografske oznake porekla poljoprivrednih i prehrambenih proizvoda. *Ekonomika poljoprivrede*, 55(2), 207-218].

22. Simin, M. J., Jovićević, P., & Novaković, S. (2016). Appellations of geographical origin as a generator of national competitiveness. Economics of Agriculture, *63*(2), 567-583.

23. Simović, K. (2015). Agro-Food Quality Schemes At Eu Level. Potential benefits of protecting Serbian products in the context of negotiations with the EU. European Policy Center. [in Serbian: Simović, K. (2015). Agro-prehrambene šeme kvaliteta na nivou EU. Potencijalne koristi zaštite srpskih proizvoda u kontekstu pregovora sa EU. Centar za Evropska politike].

24. Skallerud, K., & Wien, A. H. (2019). Preference for local food as a matter of helping behaviour: Insights from Norway. *Journal of Rural Studies*, *67*, 79-88. https://doi.org/10.1016/j.jrurstud.2019.02.020.

25. Tešanović, D., & Koprivica, M. (2007). Influence of quality definition of regional gastronomic products on formation of touristic offer of Serbia. In *International Participation conference, Recognizable national gastronomy-tourist potential, Bled, Slovenia* (pp. 217-223).

26. Teuber, R. (2011). Consumers' and producers' expectations towards geographical indications: Empirical evidence for a German case study. *British Food Journal*. https://doi.org/10.1108/00070701111148423.

27. Užar, D., Dunđerski, D., & Pejanović, V. (2022). Consumers'intention to buy cheeses with geographical indications: the case of Serbia. *Economics of Agriculture*, *69*(3), 819-832.

28. Vandecandelaere, E., Teyssier, C., Barjolle, D., Fournier, S., Beucherie, O., & Jeanneaux, P. (2020). Strengthening sustainable food systems through geographical indications: evidence from 9 worldwide case studies. *Journal of Sustainability Research*, *4*(3). https://doi.org/10.20900/jsr20200031

29. Vujović, S. (2007). Agriculture tourism as incentive factor economic development of Vojvodina. *Economics of Agriculture*, *54*(2), 215-230. [*in Serbian*: Vujović, S. (2007). Agroturizam kao podsticajni faktor ekonomskog razvoja Vojvodine. *Ekonomika poljoprivrede*, *54*(2), 215-230]. DOI: 10.22004/ag.econ.245686

30. Zarić, V., Bogdanov, N., & Vasiljević, Z. (2012). Traditional products of the Republic of Serbia - a contribution to the assessment of the institutional framework and the potential for production and protection of products. In: K. Zmaić, T. Sudarić (eds.) Tradition despite the crisis - is it possible? Vinkovci: Zebra. pp 47-58. (In Serbian).

ANALYZING THE IMPACT OF REDUCING FOOD LOSSES OF RICE ON FOOD SECURITY IN BENIN

Rico Amoussohoui[1], Kuassi Auxence Aristide Akpa[2], Smith G. Nkhata[3], Jan Banout[4]

**Corresponding author E-mail: amoussouhoui@ftz.czu.cz*

ARTICLE INFO

Original Article

Received: *xx25 July 2022*

Accepted: *15 September 2022*

doi:10.59267/ekoPolj230199A

UDC 338.439.4.053.23:633.18(668.2)

Keywords:

food losses; rice; food insecurity; food consumption score; Benin

***JEL**: Q16, Q18, R31*

ABSTRACT

A substantial amount of rice grains is lost along the value chain, contributing to food insecurity among farming households in Benin. While food losses are inevitable along the value chain, it is imperative to determine the minimum acceptable loss for rice. This study aims to quantify the food losses of rice and determine its effect on food security using the Food Consumption Score (FCS) and Linear model. The results show a positive effect of a low loss rate on the FCS. In addition, a low loss rate increases the probability of FCS by 82.4 for the overall rice farmers and 83.7 for the efficient rice producers. Thus, reducing the loss rate throughout the food chain to a maximum of 10% would increase the amount of local rice on the market and allow producers to achieve food security. The study recommends sensitizing stakeholders along the rice value chain on strategies or technologies to reduce losses.

Introduction

The rising of food prices since 2006-2008 and the threat of food shortages in the future have renewed interest in agricultural development in Sub-Saharan Africa (SSA). For the majority of the population in SSA, cereal grains are an essential component of smallholder livelihoods and form the basis for food security. Cereals account for

1 Rico Amoussouhoui, Department of Sustainable Technologies, Faculty of Tropical AgriSciences, Czech University of Life Science in Prague, Kamýcká 129, 165 00 Prague, Czech Republic. E-mail: amoussouhouirico@gmail.com, ORCID ID (https://orcid.org/0000-0002-4719-0142)

2 Kuassi Auxence Aristide Akpa, Africa Rice Center (AfricaRice), 01 BP 2551 Bouake 01, Bouake, Cote d'Ivoire. E-mail: a.akpa@cgiar.org

3 Smith G. Nkhata , Department of Agriculture and Food Systems, Faculty of Life Sciences and Natural Resources, P. O Box 143, Lilongwe, Malawi, E-mail: snkhata@luanar.ac.mw, ORCID ID (https://orcid.org/0000-0002-1936-9882)

4 Jan Banout, Department of Sustainable Technologies, Faculty of Tropical AgriSciences, Czech University of Life Science in Prague, Kamýcká 129, 165 00 Prague, Czech Republic, E-mail: banout@ftz.czu.cz, ORCID ID (https://orcid.org/0000-0002-9647-1426)

about 55% of the African basket of goods. For every 1% increase in food prices, food expenditure falls by 0.75% in developing countries. Cereal production is one of the best ways to ensure food security. According to the FAO (2018), about 374 million people suffer from severe food insecurity exacerbated by high food losses, and an effort to reduce these losses could be helpful. Rice is the second most important crop worldwide, and the demand will continue increasing given the population growth (Teye et al., 2019). Low production coupled with food losses is among the important causes of malnutrition and food insecurity. Ndindeng et al. (2021) estimated the rice's food losses in SSA at $10.24 billion, about 47.63% of the total production. According to IRRI's world statistic 2020, a huge part of the rice production in SSA in 2018 could not reach consumers' tables due to the losses along the value chain. The authors reported that about 17% of the production was lost due to inadequate equipment or practices. The challenge of food losses affects all countries, especially developing countries where farmers are still using conventional agricultural production (Balana et al., 2022). Food losses have contributed considerably to poverty, food insecurity and low quality of life in developing countries (Brander et al., 2021; Tesfaye & Tirivayi, 2018). Hashim et al. (2022) reveal that up to 70% of the food produced can be lost if an appropriate solution is not found to reduce the losses while increasing production. Reducing food losses became a common challenge and is the object of attention worldwide. In addition to quantitative losses, there is also the problem of loss of grain quality during postharvest, which can lead to loss of market opportunities and a decline in nutritional value (Bhattacharya & Fayezi, 2021).

The major causes of losses are harvesting methods, handling methods, drying techniques, storage methods, bird attacks, rats, insect damage, and parasites. By reducing quality and available quantity, food losses lead to higher prices for available food. In recent decades, a significant amount of attention and resources have been devoted to increasing food production. Increasing agricultural productivity is critical to ensuring global food security, but it is not enough. Food production currently faces the challenge of limited land and water supply and increased weather variability due to climate change. To achieve sustainable food security, food availability must also be increased by reducing food losses at the farm, retail, and consumer levels (Affognon et al., 2015). Quantitative losses of rice lead to a reduction in the volume of usable end product from harvested paddy leading to prices escalation (Morris et al., 2019). Qualitative losses are caused mainly by physical damage, which reduces the value of the usable product and renders the grains unappealing to consumers. A reduction in food losses may reduce the cost of production and retail distribution and the price to consumers. Mintenet al. (2020) stated that reducing food losses would improve food security, ensure the availability of high-quality food at lower prices, and reduce the impact on the environment.

In general, losses that occur during postharvest are due to different constraints that producers face during each step of postharvest and different methods used for each activity. These constraints and methods vary from one activity to another and have an important impact on food losses. It is then crucial to evaluate the value chain to identify

the constraints at each step and quantify the loss. This is seen as the first step to collect accurate information to propose an adequate, sustainable solution to reduce constraints and losses and guide farmers not to pass the food security border.

Benin's total rice production accounts for only 3.15% of the production of Western Africa. In the same line as the other Western African countries, Benin rice's consumption has considerably increased during the past decade, leading to an increase in local production (Maertens & Vande Velde, 2017). Moreover, Benin has defined the Development Strategic Orientations and the Growth Strategy for Poverty Reduction, which pointed to the agricultural sector as the most crucial sector for poverty reduction. Among the strategies adopted are diversification and promotion of cereal crops. Thus, a policy plan was developed to diversify agriculture with rice as the priority sub-sector. However, recent data show that Benin is one of the African countries with the highest prevalence of malnutrition, with an estimated one in five people being undernourished.

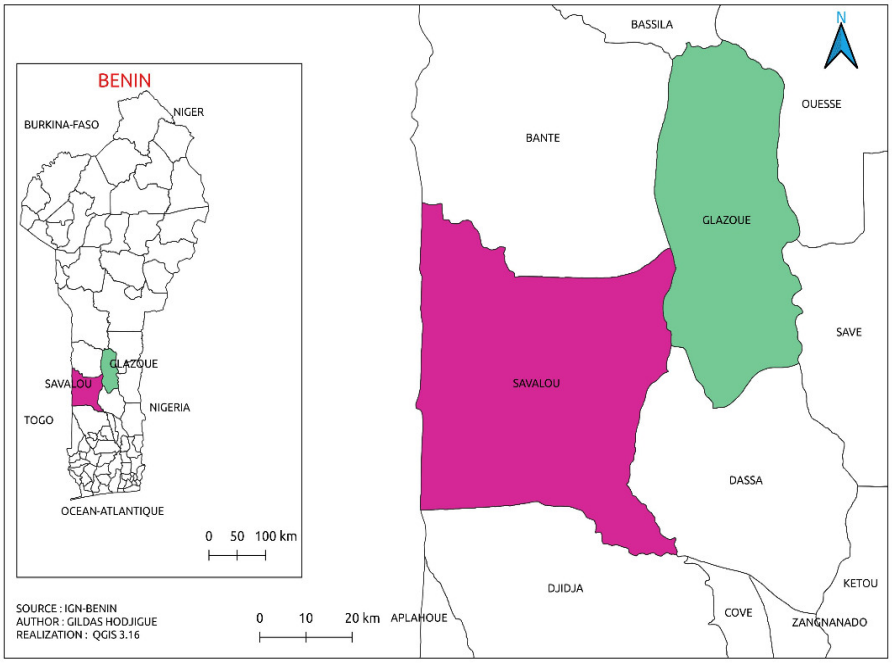
In Benin, very little literature and research were conducted to estimate and quantify the losses along with the harvest and postharvest processes. Such a study would provide the literature and policymaker accurate information on the quantified loss at each step and the constraints. Such information would also guide rice farmers to know where significant losses occur along the value chain, identify constraints related to the losses, and devise strategies to reduce losses and ensure food security. A novelty, this study aims to identify the minimum loss rate ''Authorized'' to keep farmers' food secure. This paper would be the first that provides the minimum loss rate for food security and estimate the impact of this minimum rate on the Food Consumption Score, including farmers' socio-economic characteristics. To this end, we analyze the constraints that occur during the harvest and postharvest process, quantify the food loss and estimate the impact of a low loss rate on food security.

Materials and methods

Data collection

The data used for this study were obtained from a baseline survey in Benin covering the area shown in Figure 1. Data collection was done in two communities in Benin (Glazoue and Savalou) using Mlax, an application developed by the AfricaRice Center to reduce errors and time spent on data collection. The sampling methodology for this survey was designed to include a spread of villages/communities. For the sampling of villages, the stratification criteria were the environment of rice cultivation (agro-ecosystem), accessibility to the village (based on the quality of the road to allow enumerators to reach farmers without major difficulties), and predominant crop. Based on these criteria, all villages where rice is grown in the target agro-ecosystem were first identified and listed. A total of 314 producers in 20 villages were interviewed on different postharvest activities.

Figure 1. Survey area in Benin



Identification of constraints and ranking

During the survey, each producer identified and ranked the constraints for harvest and postharvest activity. Each producer assigned a rank to each constraint. Kendall's rank correlation was used for data analysis. This non-parametric test measures the strength of dependence and gives the rank order. The following formula was used to calculate the value of Kendall's rank correlation (Abdi, 1955):

$$\tau = \frac{n_c - n_d}{1/2n(n-1)} \qquad (1)$$

Where n is the number of observations, n_c is the number of concordances and n_d the number of discordant.

Determination of food loss rates

Food loss is the loss of physical grains that occur during the harvest and postharvest activities. It is a measurable qualitative and quantitative food loss along the supply chain, starting at the time of harvest until consumption or other end uses (Balana et al., 2022). The loss rate can be estimated from the input and output for each operation. For this study, the data used were collected by enumerators who asked specific questions to the farmers on different parameters needed for the estimation at each step along the value chain. Since there were no initial paddy rice quantities for the harvest step, a

mathematical estimation was not possible. Rice farmers provided us with an intuitive estimation of the loss that normally occurs during the harvest process based on their experiences. Even though methods such as crop-cutting could be used to estimate the amount of rice on a square meter before harvest, we could not do that because the survey was organized at the end of the season after farmers had already harvested the rice.

In addition, we intended to estimate the grain loss through drying. This is because there is a loss of weight during drying due to moisture removal, which rice farmers could not estimate. We also considered that farmers could not control the weight loss due to drying. Moreover, we believe that the quantity of grain loss due to animal attacks or wind destruction could be avoided with proper protection. We estimated the loss rate as follows:

The loss rate for threshing = [(Initial quantity of paddy rice after harvesting– Final quantity of paddy rice obtained)/ Initial quantity of paddy rice after harvesting] *100

The loss rate of drying= [(Initial quantity of paddy rice after threshing – Final quantity of paddy rice obtained)/ Initial quantity of paddy rice after threshing] *100

The loss rate of winnowing = [(Initial quantity of paddy rice after drying– Final quantity of paddy rice obtained)/ Initial quantity of paddy rice after drying] *100

The loss rate of storage = [(Initial quantity of paddy rice after winnowing– Final quantity of paddy rice obtained)/ Initial quantity of paddy rice after winnowing] *100

Determination of FCS

The food security analysis was performed using the FCS, which is a proxy indicator of household food security based on the weighted frequency of intake of eight food groups. Therefore, the FCS is a pertinent indicator of the accessibility dimension of food security and the quality of food consumption affecting the nutritional status (World Food Program, 2008). The score is based on the frequency of food consumption which is a specific context and measured over a recall period of seven days. Foods were regrouped for analysis into eight groups (*Table 1*.) which are weighted by a value corresponding to their estimated nutritional role. Measurement of quantity was not included in the calculation of FCS. However, foods consumed in very small amounts were recorded as condiments (except for oil and sugar), in order not to overestimate the consumption of certain foods such as meat or fish, which can often be used to complement sauces, but whose nutritional intake is limited. The FCS is calculated using the following formula:

$$FCS = \sum_{i=1}^{8} (a\_i \; x\_i) \qquad (2)$$

Where i = food group, a = weight, x = frequency.

Table 1. Food groups, weights, and levels of FCS

Food items	**Food groups**	**Weight**
Maize, rice, sorghum, millet, pasta, bread, and other cereals Cassava, potatoes, and sweet potatoes	Cereals and tubers	2
Beans, peas, groundnuts, and cashew nuts	Pulses	3
Vegetables and leaves	Vegetables	1
Fruits	Fruit	1
Beef, goat, poultry, pork, eggs, and fish	Meat and fish	4
Milk yogurt and other diaries	Milk	4
Sugar and sugar products	Sugar	0.5
Oils, fats, and butter	Oil	0.5
Levels of FCS and categorized profiles		
Levels of FCS	Profile	
0-21	Poor level of consumption	
21.5-35	Borderline of consumption	
>35	Acceptable level of consumption	

Source: (World Food Program, 2008)

The FCS captures both qualitative (different food groups/dietary variety) and quantitative (food frequency) elements of food security. A positive correlation has been demonstrated between measures of caloric intake and the food poverty line. The main criticism of this indicator is that it does not take into account individual dietary needs or seasonal variations. Therefore, we estimated three FCS for each household: one for the abundance period, one for the average availability period, and one for the lean or scarcity period. The thresholds were used to divide households into these three groups. The cut-off points were used to categorize households into three FCS profiles (*Table 1.*).

Estimation of the effect of constraints on food loss

Several factors have a positive or negative effect on the loss rate. It is important to note that the loss rate, assimilated with the index of technical efficiency, allows us to hypothesize that the registered losses are due to producers' responsibility (technical errors) and to random factors that are not controllable by producers. Thus, the controllable factors are most often associated with the technical performance of producers, which are affected by physical constraints. These constraints affect the loss rate at different levels of postharvest processes. Tobit regression was used to identify the constraints that have the greatest influence on the loss rate throughout the postharvest process. In this study, the total loss rate was estimated as the sum of the loss rate calculated at each level of the postharvest process. A bootstrap option was used to obtain robust standard errors in the estimation. To investigate the factors affecting postharvest losses at the farm level in food rice, functional analysis was carried out as described by Nag et al. (2000).

Linear model with endogenous treatment effects

The endogenous regression model is also known as the *endogenous binary variable.* This uses a linear model for the outcomes and forces a normal distribution to model gaps to the conditional independence assumptions of the estimators. In treatment effect jargon, the endogenous binary variable model is a linear potential outcome model that allows for a specific correlation between the unobservable structure affecting the treatment and the unobservable factors affecting the potential outcomes. Heckman (1978, 1976) studied this model and investigated some empirical applications of it, and described it as an endogenous switching model limited. Barnow et al. (1981) provided another useful branch of this model. That model focuses on the derivation of the conditions for which, using the Ordinary Least Squares estimator of the treatment effect, δ is nonzero and has a particular sign. Wooldridge (2010) examined the binary endogenous variable model as an endogenous treatment effects model, following up on recent work. Formally, the endogenous treatment regression model consists of an equation with an outcome y_j and endogenous treatment t_j. The objective is to determine the effect of the endogenous treatment (representing the loss rate) on food security over the total food consumption value. Since the endogenous variable must be binary, we made the loss rate variable binary, following the logic of technical efficiency explained by Farrell (1957). Just like the level of technical efficiency, the loss rate is an index used to evaluate the technical efficiency of producers and agents. Thus, the technical inefficiency observed in an actor consists of two parts. Firstly, inefficiency due to the fault of the producer; secondly, inefficiency due to random phenomenal effects that cannot be controlled by the producer. Then, we categorized the loss rate variable into two intervals.

0-10 (coded 1): The producers with an overall loss rate between 0 and 10%. These producers were categorized as "efficient" because we assume that the actors' 10% losses are due to random effects or uncontrollable factors. The causes of food losses are multiple and are not all related to the technical performance of the producer/actor but may be attributed to events such as floods, drought, or theft.

Over 10 (coded 0): are producers with an overall loss of over 10%. These producers were thus classified as "less effective/inefficient" because they have a high loss rate that can severely affect their incomes and food security. Such significant losses can not be entirely attributed only to uncontrollable factors but also to the technical performance of the producers.

To achieve our objective, we used a simultaneous equation model that allowed us to combine the two equations in our study (the " FCS equation with the endogenous variable" and the " food loss rate" equations). The advantage of this model is that, in addition to the linear regression estimates, it allows us to obtain the "Average Treatment Effect" (ATE) and Average Treatment Effects on Treated (ATET). This model also allows us to identify the determinants of low loss rates (0-10%). The equation system is made up of equations (3) and (4):

$$\begin{cases} fcs_j = \sum_j \theta_j \mu_j + \delta_j hphl_j + \varepsilon_j & (3) \\ hphl_j = \sum_j \delta_j x_j + \epsilon_j & (4) \end{cases}$$

Where *fcs* represents food consumption indices which are a truncated variable between 0 and 1;

x_j, and μ_j represent independent variables. *hphl* is the endogenous variable that connects the two equations. This method allowed us to simultaneously have both the value and the signs of the coefficients and the ATE and ATET resulting from loss levels.

Results and discussions

Characteristics of farmers

The results (*Table 2*.) show that the average age of farmers was 46 years. This shows that the respondents were adults and could decide on the choice of technologies and methods used during production and postharvest. The average household size was 7.22, and the average rice income per year was $384. The respondents had an average experience of 7.27 years in rice production. This means that most producers were proficient in rice production. More than half of the farmers had received training, which is an important factor in understanding the food losses and the adoption of technologies. Membership of the agricultural association is one of the means to improve access to new information (Raghunathan et al., 2019). It allows farmers to easily access information on new technologies, behaviors, methods, equipment, and techniques recommended to reduce food losses.

Table 2. Socio-economic characteristics of farmers

Variables	Mean	Minimum	Maximum	Std. Deviation
Age (Years)	46	19	80	12.06
Household size	7.22	1	18	2.86
Rice income ($/Year)	384	30	2520	440
Experience in rice production (Years)	7.27	1	42	9.34
Area of rice (ha)	1.01	0.1	8	1.36
Gender Male (%)	85.42	-	-	35.41
Group Membership (%)	61.11	-	-	48.91
Formal Education (%)	54.86	-	-	49

Identification of harvest and postharvest constraints and ranking

Many studies focus on the causes of losses and ignore the real constraints faced by producers. Tadesse et al. (2018) pointed out that the losses incurred at each step vary according to the organization and technology used in the food supply chain. It includes all activities from production to the final product for the end customer (Goletti &

Samman, 2007). The losses from one activity to another and the constraints faced by producers during each activity vary. The results show that the first major constraint during harvesting, drying, threshing, storage, transportation, and ginning is the "difficulty in obtaining equipment" (*Table 3.*). According to Hodges et al. (2011), greater losses in developing countries occur during harvesting. drying, storage, processing, and transportation where the supply chain is less mechanized. These constraints could be addressed by using mechanization or improved technology to reduce losses. Besides, there are higher labor costs associated with drying and threshing and losses due to rodents and insects. All these constraints are mainly due to external factors. These constraints require technologies to improve traditional methods and reduce losses at each step. These findings align with Kiaya (2014), who stated that postharvest technologies could contribute to food security in several ways. They can reduce postharvest losses and thereby increase the amount of food available for consumption by farmers and poor rural and urban consumers.

Table 3. Summary of constraints and ranking by activities

Activities	Constraints	Rank	Average	Test result
Harvest	Difficult acquisition of equipment	1	1.83	W de Kendall 0.47***
	Relevance of method	2	1.92	Khi-deux 16.95
	Physical loss of grain during harvest	3	3.08	
Threshing	High cost of labor	1st	2.90	W de Kendall 0.033***
	Difficult acquisition of equipment	2nd	3.27	Khi-deux 15.04
	High loss rate	3rd	3.79	
Drying	Difficult acquisition of equipment	1st	2.68	W de Kendall 0.033***
	High cost of labor	2nd	2.87	Khi-deux 15.04
	Difficult management of equipment	3rd	3.08	
Storage	Loss caused by rodents	1st	2.77	W de Kendall 0.09***
	High cost of storage products	2nd	3.35	Khi-deux 49.93
	Loss caused by insects	3rd	3.44	
Transport	High cost of transport	1st	2.19	W de Kendall 0.06***
	Distance from market higher	2nd	2.52	Khi-deux 18.16
	Difficult access to market	3rd	2.55	
Winnowing	Difficult acquisition of equipment	1st	3.25	W de Kendall 0.02***
	Labor cost higher	2nd	3.43	Khi-deux 35.46
	Difficult management of equipment	3rd	3.71	

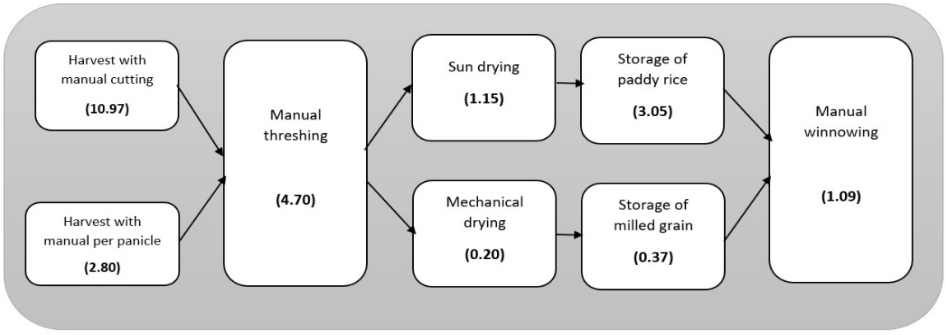
*P <0.01, **P <0.05 and ***P <0.001

Estimation of food loss rates

Food losses of rice occur from harvest to consumption. *Figure 2.* shows the average loss rate for the main methods used in each activity from harvest to storage. Based on the methods used, it can be seen that the mechanical method is used to a very low extent and, as expected, recorded the lowest loss rate (0.2%). In Benin, 76% of the agricultural operations are manual, 23% with animal traction and only 1% are mechanized (Mounirou, 2018). Manual cutting contributes a high loss rate of 11%, while manual panicle cutting

contributes a loss rate of only 3% for the harvesting activity. In 2007, the International Rice Research Institute estimated the loss during harvesting to be between 5 and 16%, and a further 5 to 21% is lost during drying, storage, milling, and processing (Sadiq Saba & Ishaq Ibrahim, 2018). It is known that the harvesting process includes other activities such as crop handling, threshing, and grading. Redfern et al. (2012) reported similar estimates of rice losses in Southeast Asia. A survey conducted in 13 member countries of the Africa Rice Center showed that some major problems common to many countries are improper harvesting and field management practices that cause severe food losses. The Africa Rice study shows that the estimated losses during harvest and postharvest are about 15 to 50% of the market value and are as high as $30 to $75 per ton (Sadiq Saba & Ishaq Ibrahim, 2018). The findings of this study are also supported by the findings of Appiah et al. (2011), who found that harvesting losses ranged from 3.03 to 12.05% using the panicle and sickle method; threshing losses ranged from 0.53 to 4.04% using the traditional method commonly known as "Bambam" method in Ghana while drying losses ranged from 1.57 to 1.76%. Despite increasing agricultural production, qualitative and quantitative postharvest losses along the rice value chain remain very high due to poor postharvest practices (Mopera, 2016). Often, qualitative losses are due to physical damage on the grains resulting from high levels of breakage, chalky grains, and the presence of impurities, which are usually sold unbranded (Mopera, 2016; Ndindeng et al., 2015). Efforts to reduce postharvest losses to 10% would significantly increase the availability of rice on the market, thereby increasing the availability of locally produced rice within the short term (Ndindeng et al., 2015). A systematic analysis of the overall value chain with the participation of the actors is the logical first step in designing an appropriate strategy or technology to reduce food losses.

Figure 2. Diagram of food losses along the value chain



Determination of the FCS

In the case of this study, the FCS is used to estimate the level of food security among farmers. *Table 4.* shows the frequency of food consumption rating by gender on three intervals of FCS rating. These results indicate that 28.5% of households where the household heads are "male" fall within FCS between "0-21" compared to the 14.3% of female-headed households. We find that the frequency of female-headed households

falling within FCS between "21.5-35" is significantly higher than for males. At the acceptable FCS, we find that 58.5% of male-headed households have a level of FCS greater than 35, compared to 47.6% in a female-headed household. These results can be justified since the responsibilities in the rural household are not always the same for men and women. However, this could be different if men and women are put in the same condition, which is usually not the case in African society, especially in a rural household. However, international organizations know and recognize that gender equality is also a key for achieving food security (Garcia & Wanner, 2017). Overall, 56.9% of the farmers have an FCS of more than 35, which means that more than half of the households have an acceptable level of food intake. But this again leaves 44.6% that need to improve their food security level by increasing production capacity and reducing food losses in order to make more food available.

Table 4. FCS estimation

Levels of FCS	Decision	Frequency (%)		
		Male	Female	Together
0-21	Poor level of consumption	28.46	14.29	26.39
21.5-35	Borderline of consumption	11.38	38.10	15.28
>35	Acceptable level of consumption	58.54	47.62	56.94

Determination of the effect of the constraints on food losses

This part of the study focused on the effect of constraints on losses. Thus, the two main constraints were taken at each step of the postharvest process level, and a Tobit regression was used (*Table 5.*). In addition, socioeconomic characteristics were used to triangulate with the food loss rates. The results show that overall the model is significant at a 1% level. Quantity, gender, and group membership are the socio-economic variables used in the model. Quantity and gender are significant at 5% and 1%, respectively. These results show that the quantity produced positively and significantly affects the loss rate. Moreover, a negative sign in gender means that male farmers tend to have higher losses than female farmers. Women would inherently have management skills that enable them to improve their effectiveness. These results agree with those of Tadesse et al. (2018), who also found that gender and size of production were among the determinants of food losses in potato production. This is in contrast to the findings of Aidoo et al. (2014), who found that female farmers are more prone to high losses than their male counterparts. In the same line, Cole et al. (2018) found that women experience more losses in fishing activities because they often have less time and have limited access to processing, storage, and handling technologies.

On the other hand, Babatunde et al. (2019) reported that household size and farm size are the determinants of food losses in rice production. We see that all significant constraints have a negative impact on losses. Thus, lack of equipment, higher cost of labor, higher cost of stored products, and higher cost of transportation negatively impact food losses, which can be addressed by providing farmers with new technologies or equipment to effectively reduce food losses.

Table 5. Summary result of Tobit regression

	Variables	**Coefficient**
	Constant	114.87*** (40.27)
Harvesting	Lack of equipment	-35.40 (33.89)
	Labor cost higher	-21.01(21.98)
Threshing	Labor cost higher	14.01(12.47)
	Lack of equipment	-26.35*(14.52)
Drying	Labor cost higher	-20.40*(12.21)
	Lack of equipment	-5.60 (22.65)
Storage	Cost of products higher	-32.66**(13.96)
	Rodent	1.195 (9.20)
Transport	Cost of transport higher	-11.75 (8.66)
	Long-distance	-1.70 (9.84)
Winnowing	Labor cost higher	-36.57***(14.02)
	Lack of equipment	-45.67***(16.14)
Socioeconomics factors	Quantity produces	0.01***(0.00)
	Gender (1=male)	-157.51***(27.57)
	Members of group (1=Yes)	-12.92 (8.10)

*P <0.01, **P <0.05 and ***P <0.001

Impact of low loss rate on FCS: ATE and ATET

Increasing agricultural productivity is critical to ensuring global food security, but it may not be enough. Food production currently faces the challenge of limited land and water supply and increased weather variability due to climate change. Food availability must also be increased by reducing losses during the harvest and postharvest processes at the farm, retail, and consumer levels to sustain food security goals.

As stated in the methodology, these parts of the study allow us to measure the effect of a low loss rate (0-10%) on the level of food consumption. Indeed, since the main objective is to reduce losses as much as possible, the second part of this model shows the factors that determine a low loss rate. The results (*Table 6.*) show that the model is globally significant at a 1% level. The likelihood ratio also shows that we can reject the null hypothesis that there is no relationship between treatment errors (low loss rate) and misperceptions (FCS). In the first part of the model, we can see that the variable "low loss rate" is positive and significant at 1%. These results prove that a low loss rate positively affects the FCS. Thus, reducing the loss rate to a maximum of 10% in the whole food chain would allow producers to achieve food security. The more the loss rate decreases throughout the food chain, the more food is available to consumers qualitatively and quantitatively, which may ultimately lead to food security.

A likely solution is to prevent losses by relying on the availability of the actors working in food management, the appropriate technologies, and the necessary information that would assist farmers in reducing food losses. According to the 2013 Advancing Food Security report of the Chicago Council on Global Affairs, there is a recommendation for action to "halve food losses by 2023" (Bertini and Glickman, 2013). The authors

argued that ‘’without adequate infrastructure for crop storage and transportation, enormous amounts of food are lost on the way from the farm to the consumer’s table and therefore, efficient food management systems are required (IFPRI, 2019). Indeed, recent studies provide evidence that food losses are substantial, with one commonly cited estimate stating that one-third of the world’s agricultural production is wasted. However, the idea that reducing food losses can impact food security is not necessarily new. Moreover, other variables besides the loss rate influence the level of food consumption. For example, the model shows that the variables “number of days per month or household having one meal per day”; “one meal per week” and “number of days without food,” although significant, have a negative effect on farmers’ FCS. These results can be explained by the fact that the frequency of food consumption is a very important factor that positively affects household food security. The higher the frequency of consumption, the more the farmers tend towards food security.

The second part of our model shows factors that determine the low loss rate. Among these variables, we have: “the use of manual equipment” (hand-held devices), significant at 1%, negatively affecting the low loss rate. This result once again shows the importance of adopting mechanized equipment to reduce losses at all stages. Capacity and machinery building is crucial to address these losses. Implementation of appropriate protective measures should be encouraged to reduce losses during milling and threshing. Area, group membership, technical efficiency, and education are also positive and significant. The larger the area, the lower the loss rate. This result can be explained by the fact that producers with large holdings use the most equipment to reduce losses and working time. Groups or producer associations are more often places for information exchange and training in technology. Thus, producer members of a group are more likely to have the opportunity to receive information and benefit or other advantages from training. Technical efficiency is an index that shows the performance of producers in using these inputs rationally. So a producer with technical efficiency will have a low rate loss, which explains the positive effect on low rate losses. Education is a factor that facilitates the understanding and management of production.

Table 6. Result of simultaneous equation/ FCS and low-rate loss

Variables	**Coefficient**
Food consumption score	
Number of days per month / one meal per day	-0.01***(0.002)
Three meals per day	25.95*(13.81)
One meal per week	-40.73**(18.11)
Numbers of days without food	-2.61***(0.61)
Number of days per month / two meals per day	32.45*(17.18)
Food loss [0 – 10]#c. Sex	
0	-1.66(13.43)
1	35.13**(17.92)
Food loss [0 – 10]	51.18***(19.18)
Constant	-26.53(27.00)
Food loss [0 – 10]	

Variables	Coefficient
Age	0.01(0.01)
Manual equipment	-2.23***(0.71)
Area	1.69**(0.66)
Members of group	0.83***(0.27)
Technical efficiency	1.16**(0.60)
Instructs	0.74**(0.29)
Constant	-0.93(0.68)
/athrho	-1.40***(0.50)
/lnsigma	3.72***(0.16)
rho	-0.88(0.10)
sigma	41.54(6.76)
lambda	-36.85(10.12)
*P <0.01, **P <0.05 and ***P <0.001	

The results also show the average treatment effect (ATE) of all producers and the average treatment effect of "efficient" producers (ATET) (*Table 7.*). The results suggest that a low loss rate increases the probability of improvement in the FCS to 82.4. The probability of improvement in the FCS of efficient producers (with loss rates between 0 and 10) is 83.7. These results confirm that rice producers' low loss rate (between 0 and 10%) positively affects their food security.

Table 7. ATE and ATET estimation

	Efficiency level	Probability	Standard error
ATE	(1* vs 0**)	82.36	23.36
ATET	(1 vs 0)	83.68	23.87

*: Efficient; **: Less efficient

Conclusion and policy implications

Food insecurity, lack of nutritional diversity, and food losses are major problems in much of the developing world. Clearly, food production must be significantly increased to meet the future needs of a growing population. This study has expanded our knowledge of the relationship between food losses and food security. Using descriptive analysis and the application of an econometric model (linear regression and simultaneous equations), this study showed that a low loss rate of rice has a positive effect on food security. Thus, reducing the loss rate to a maximum of 10% in the whole food chain would allow producers to achieve food security. The use of manual methods can increase the loss rate of rice. Therefore, there is a need to emphasize measures to reduce losses during harvest and postharvest. These measures need to consider the various activities taking place from harvest to the point of sale that might increase the loss rate of rice. It is important firstly, educate the actors in the rice value chain on the issue of food losses through training and awareness-raising as suggested by Morris et al. (2019); secondly, to inform the chain actors of the importance and necessity of using improved technologies and equipment that could reduce food losses; and finally,

to disseminate new and practical methods that will enable producers to remain efficient in their operations and reduce losses. This requires a holistic approach involving value chain actors, development partners, and policymakers to come together to develop and introduce new, affordable and accessible technologies and approaches that could significantly reduce food losses. The authors acknowledge that the study has some limits, which can be summarized in two points:

- The initial sample size is bigger, but we could not get accurate information since farmers provided an intuitive estimation of the loss. The estimation is sometimes complicated, even impossible for some farmers. We would suggest a bigger sample and broaden the overall community producing rice study.
- Minten et al. (2020) mentioned that there is a difference between the intuitive estimates of loss provided by farmers and directly measured losses. However, the authors believe that it won't be a significant difference in the finding. A more structured study could be initiated to measure the loss at each step directly.

Data availability and material: The data used for the analysis are available and will be provided on request.

Ethical Statement

Funding: No funding was received for conducting this study.

Conflict of interest

The authors declare that they have no conflict of interest.

Informed consent

This study is based on quantitative data collected from rice farmers who consent to participle in the study.

References

1. Abdi, H. (1955). The Kendall Rank Correlation Coefficient. *Encyclopedia of Measurement and Statistics*, 1–7. https://doi.org/10.1.1.66.9039
2. Affognon, H., Mutungi, C., Sanginga, P., & Borgemeister, C. (2015). Unpacking postharvest losses in sub-Saharan Africa: A Meta-Analysis. *World Development*, *66*, 49–68. https://doi.org/10.1016/j.worlddev.2014.08.002
3. Aidoo, R., Danfoku, R. A., & Mensah, J. O. (2014). *Journal of Development and Agricultural Economics Determinants of postharvest losses in tomato production in the Offinso North district of Ghana*. *6*(8), 338–344. https://doi.org/10.5897/JDAE2013.0545
4. Appiah, F., Guisse, R., & Dartey, P. K. A. (2011). Post harvest losses of rice from harvesting to milling in Ghana. *Journal of Stored Products and Postharvest Research*, *2*(4), 64–71. https://academicjournals.org/journal/JSPPR/article-full-text-pdf/4FA055C8791

5. Babatunde, R., Omoniwa, A., & Aliyu, J. (2019). Post-Harvest Losses along the Rice Value Chain in Kwara State, Nigeria: An Assessment of Magnitude and Determinants. *Cercetari Agronomice in Moldova*, *52*(2), 141–150. https://doi.org/10.2478/cerce-2019-0014

6. Balana, B. B., Aghadi, C. N., & Ogunniyi, A. I. (2022). Improving livelihoods through postharvest loss management: evidence from Nigeria. *Food Security*, *14*(1), 249–265. https://doi.org/10.1007/S12571-021-01196-2/TABLES/7

7. Barnow, B., Cain, G., & Goldberger, A. (1981). Issues in the analysis of selectivity bias. In *Evaluation Studies Review Annual: Vol. Vol. 5. Sa*. https://files.eric.ed.gov/fulltext/ED202979.pdf

8. Bertini, C., & Glickman, D. (2013). *Advancing global Food Security : The power of Science, Trade, and Business*. https://www.thechicagocouncil.org/sites/default/files/2020-12/2013_Advancing_Global_Food_Security-Report.pdf

9. Bhattacharya, A., & Fayezi, S. (2021). Ameliorating food loss and waste in the supply chain through multi-stakeholder collaboration. *Industrial Marketing Management*, *93*, 328–343. https://doi.org/10.1016/J.INDMARMAN.2021.01.009

10. Brander, M., Bernauer, T., & Huss, M. (2021). Improved on-farm storage reduces seasonal food insecurity of smallholder farmer households – Evidence from a randomized control trial in Tanzania. *Food Policy*, *98*. https://doi.org/10.1016/J.FOODPOL.2020.101891

11. Cole, S. M., Mcdougall, C., Kaminski, A. M., Kefi, A. S., Chilala, A., Chisule, G., Cole, S. M., Mcdougall, C., Kaminski, A. M., Kefi, A. S., Chilala, A., & Chisule, G. (2018). Postharvest fish losses and unequal gender relations: drivers of the social-ecological trap in the Barotse Floodplain fishery, Zambia. *Ecology and Society*, *23*(2), 1–13. https://doi.org/10.5751/ES-09950-230218

12. FAO, UNICEF, IFAD, WFP, & WHO. (2018). *The State of Food Security and Nutrition in the World: Building Climate resilience for Food Security and Nutrition*. www.fao.org/publications

13. Farrell, M. J. (1957). The Measurement of Productive Efficiency. *Journal of the Royal Statistical Society. Series A (General)*, *120*(3), 253. https://doi.org/10.2307/2343100

14. Garcia, A. S., & Wanner, T. (2017). Gender inequality and food security: lessons from the gender-responsive work of the International Food Policy Research Institute and the Bill and Melinda Gates Foundation. *Food Security*, *9*(5), 1091–1103. https://doi.org/10.1007/S12571-017-0718-7/TABLES/3

15. Goletti, F., & Samman, E. (2007). Post-Harvest Systems in World Agriculture. In P. Golob, G. Farrell, & J. E. Orchard (Eds.), *Crop Post-Harvest: Science and Technology, Volume 1* (pp. 1–34). Blackwell Science Ltd. https://doi.org/10.1002/9780470751015.ch1

16. Hashim, N., Onwude, D. I., & Maringgal, B. (2022). Technological advances in postharvest management of food grains. *Research and Technological Advances in Food Science*, 371–406. https://doi.org/10.1016/B978-0-12-824369-5.00016-6

17. Heckman, J. (1978). Dummy Endogenous Variables in a Simultaneous Equation System. *Econometrica*, *46*(4), 931–959. https://econpapers.repec.org/RePEc:ecm:emetrp:v:46:y:1978:i:4:p:931-59

18. Heckman, J. J. (1976). The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for Such Models. *National Bureau of Economic Research*, *5*(4). https://www.nber.org/system/files/chapters/c10491/c10491.pdf

19. Hodges, R. J., Buzby, J. C., & Ben Nett, A. N. D. B. (2011). Foresight Project on Global Food and Farming Futures Postharvest losses and waste in developed and less developed countries: opportunities to improve resource use. *Journal of Agricultural Science*, *149*, 37–45. https://doi.org/10.1017/S0021859610000936

20. IFPRI. (2019). *2019 Global Food Policy Report*. https://doi.org/10.2499/9780896293502

21. Kiaya, V. (2014). *Post-harvest Losses and Strategies to reduce them*. https://www.actioncontrelafaim.org/wp-content/uploads/2018/01/technical_paper_phl__.pdf

22. Maertens, M., & Vande Velde, K. (2017). Contract-farming in Staple Food Chains: The Case of Rice in Benin. *World Development*, *95*, 73–87. https://doi.org/10.1016/J.WORLDDEV.2017.02.011

23. Minten, B., Tamru, S., & Reardon, T. (2020). Post-harvest losses in rural-urban value chains: Evidence from Ethiopia. *Food Policy*, 101860. https://doi.org/10.1016/j.foodpol.2020.101860

24. Mopera, L. E. (2016). Food Loss in the Food Value Chain: The Philippine Agriculture Scenario. *Journal of Developments in Sustainable Agriculture*, *11*, 8–16.

25. Morris, K. J., Kamarulzaman, N. H., & Morris, K. I. (2019). Small-scale postharvest practices among plantain farmers and traders: A potential for reducing losses in rivers state, Nigeria. *Scientific African*, *4*, e00086. https://doi.org/10.1016/j.sciaf.2019.e00086

26. Mounirou, I. (2018). Agricultural Mechanization as an Expansion Factor of Cropland in Benin: The Case of Tractors. *Sustainable Agriculture Research*, *7*(4). https://doi.org/10.5539/SAR.V7N4P1

27. Nag, K. S., Nahatkar, S. B., & Sharma, H. O. (2000). Post-harvest losses of chickpea as perceived by the producers of Sehore District of Madhya Pradesh. *Agricultural Marketing*, *43*(3), 12–16.

28. Ndindeng, S. A., Candia, A., Mapiemfu, D. L., Rakotomalala, V., Danbaba, N., Kulwa, K., Houssou, P., Mohammed, S., Jarju, O. M., Coulibaly, S. S., Baidoo, E. A., Moreira, J., & Futakuchi, K. (2021). Valuation of Rice Postharvest Losses in Sub-Saharan Africa and Its Mitigation Strategies. *Rice Science*, *28*(3), 212–216. https://doi.org/10.1016/J.RSCI.2021.04.001

29. Ndindeng, S. A., Manful, J., Futakuchi, K., Mapiemfu-Lamare, D., Akoa-Etoa, J. M., Tang, E. N., Bigoga, J., Graham-Acquaah, S., & Moreira, J. (2015). Upgrading the quality of Africa's rice: a novel artisanal parboiling technology for rice processors in sub-Saharan Africa. *Food Science & Nutrition*, *3*(6), 557–568. https://doi.org/10.1002/fsn3.242

30. Raghunathan, K., Kannan, S., & Quisumbing, A. R. (2019). Can women's self-help groups improve access to information, decision-making, and agricultural practices? The Indian case. *Agricultural Economics*, *50*(5), 567–580. https://doi.org/10.1111/AGEC.12510

31. Redfern, S. K., Azzu, N., & Binamira, J. S. (2012). Rice in Southeast Asia: facing risks and vulnerabilities to respond to climate change. In A. Meybeck, J. Lankoski, S. Redfern, N. Azzu, & V. Gitz (Eds.), *Building resilience for adaptation to climate change in the agriculture sector. Proceedings of a Joint FAO/OECD Workshop, Rome, Italy, 23-24 April 2012* (pp. 295–314).

32. Sadiq Saba, S., & Ishaq Ibrahim, H. (2018). Postharvest Loss in Rice: Causes, Stages, Estimates and Policy Implications. *Agri Cultural Research & Technology*, *15*(4), 1–4. https://doi.org/10.19080/ARTOAJ.2018.15.555964

33. Tadesse, B., Bakala, F., & Mariam, L. W. (2018). Assessment of postharvest loss along potato value chain: The case of Sheka Zone, southwest Ethiopia. *Agriculture and Food Security*, *7*(1), 18. https://doi.org/10.1186/s40066-018-0158-4

34. Tesfaye, W., & Tirivayi, N. (2018). The impacts of postharvest storage innovations on food security and welfare in Ethiopia. *Food Policy*, *75*, 52–67. https://doi.org/10.1016/J.FOODPOL.2018.01.004

35. Teye, E., Amuah, C. L. Y., McGrath, T., & Elliott, C. (2019). Innovative and rapid analysis for rice authenticity using hand-held NIR spectrometry and chemometrics. *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, *217*, 147–154. https://doi.org/10.1016/J.SAA.2019.03.085

36. Wooldridge, J. M. (2010). Econometric Analysis of Cross Section and Panel Data. *MIT Press Books*, *1*. https://ideas.repec.org/b/mtp/titles/0262232588.html

37. World Food Program. (2008). *Technical Guidance Sheet: Food Consumption Analysis/Calculation and use of the food consumption score in food security analysis*. https://documents.wfp.org/stellent/groups/public/documents/manual_guide_proced/wfp197216.pdf

LOCAL DEVELOPMENT INITIATIVES IN SERBIA'S RURAL COMMUNITIES AS PREREQUISITE FOR THE LEADER IMPLEMENTATION: AGRICULTURAL ADVISORS' PERCEPTIONS

Vesna Paraušić[1], Zorana Kostić[2], Jonel Subić[3]

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

ARTICLE INFO

Original Article

Received: *27 July 2022*

Accepted: *28 September 2022*

doi:10.59267/ekoPolj2301117P

UDC 316.334.55:631.1.017.3]:0 05.572(497.11)

Keywords:

local development initiatives, leader approach, rural development, quality of life, agricultural advisors

***JEL**: O13, O15,O18, 021, P25, Q18*

ABSTRACT

The Leader approach, as a national measure of rural development is still in the initial development phase in the Republic of Serbia. In the coming period, more intense support for the implementation of this measure is expected, from the national/regional/local budget and through the IPARD III 2021-2027 pre-accession support program. How effectively the available support funds will be used largely will depend on local stakeholders in rural communities, primarily citizens and civil society representatives, and the capacity of their development initiatives. Based on the perceptions of 118 agricultural advisors involved in the study and using descriptive statistics, one-way analysis of variance and Pearson's coefficient, the authors found a moderately capacity of local development initiatives in rural communities in the Republic of Serbia that does not differ by the regions, as well as the moderate positive correlation between the quality of life and capacity of local development initiatives.

Introduction

Nearly 40% of the population in the Republic of Serbia lives in rural areas (Babović, 2022)[4], which are characterized by numerous systemic and structural economic, social, institutional and infrastructural developmental constraints. They are reflected

1 Vesna Paraušić, PhD, Senior Research Associate, Institute of Agricultural Economics, Volgina 15 Street, 11000 Belgrade, Serbia, Phone: +381 63 1536276, E- mail: vesna_pa@iep.bg.ac.rs, ORCID ID (https://orcid.org/0000-0001-6193-5297)

2 Zorana Kostić, PhD, Assistant Professor, Faculty of Mechanical Engineering, University of Niš, Aleksandra Medvedeva 14 Street, 18000 Niš, Serbia, Phone: +381 64 6144660, E-mail: zorana.kostic@masfak.ni.ac.rs, ORCID ID (https://orcid.org/0000-0001-8974-3916)

3 Jonel Subić, PhD, Principal Research Fellow, Institute of Agricultural Economics, Volgina 15 Street, 11000 Belgrade, Serbia, Phone: +381 63 296111, E-mail: jonel_s@iep.bg.ac.rs, ORCID ID (https://orcid.org/0000-0003-1342-1325)

4 In the absence of Eurostat's urban-rural typology for NUTS 3 regions, official statistics and domestic literature have accepted the so-called "other" settlements (typology based on administrative-legal criteria) as the closest to rural.

in intensive depopulation, underdeveloped labor market, slow farm restructuring, rural poverty, high migration, especially of women, young and highly-educated people, which further worsens the situation and opportunities for these areas (Babović, 2022; Bogdanov, 2007; Joldžić, Batrićević, Stanković & Paunović, 2019; Kotevska & Martinovska Stojcheska, 2015; Strategy of Agriculture and Rural Development of the Republic of Serbia 2014–2024; Živojinović, Ludvig & Hogl, 2019).

Rural development requires much more than declarative and political support, and within the balanced territorial development, it will be key to achieving set of sustainable development goals in the Republic of Serbia by 2030 (Babović, 2020; Joldžić, Batrićević, Stanković & Paunović, 2019; Radukić, Petrović-Ranđelović & Kostić, 2019; United Nations, 2015). In planning and implementing of the rural development process, it's important to view rural areas as high value territories, with heterogeneous local characteristics and resources, with a focus on needs and initiatives of local inhabitants, networking (intersectoral and vertical at the local-regional and national level), and respecting the principle of democratic decision-making (Popescu & Andrei, 2011;Cizler, 2013; Djukić, Volić, Tišma & Jelinčić, 2014; Ilić, Pavloska Gjorgjieska & Ciaian, 2019; Janković, 2012; Popović, Katić & Savić, 2011; Rodriguez, 2010; Vujičić, Ristić & Ćirić, 2013; Popescu et al., 2017).

The LEADER approach, which has proven its effectiveness in promoting rural development in EU, is useful in many ways for development of rural areas in the Republic of Serbia, and in the Western Balkans countries in general, which are in the process of harmonizing with the EU's common agricultural policy (CAP) (Ilić, Pavloska Gjorgjieska & Ciaian, 2019; Popović, Katić & Savić, 2011). At the same time, developed and strong local initiatives of citizens and civil sector representatives, among other things, will be an important prerequisite for implementing the Leader approach and "attracting" financial support for the implementation of this measure, especially after its accreditation under the IPARD III program.

Given the above, and based on the perceptions of agricultural advisors involved in the research, authors will try to answer the following three research questions: (1) What is current state of local development initiatives in rural communities of the Republic of Serbia? (2) Is there a statistically significant difference of the state of local development initiatives in rural communities by region (NUTS 2 level)? (3) What is direction and strength of correlation between the state of local development initiatives and the quality of life adapted to the needs of young people in the rural communities of the Republic of Serbia?

The goal of the research is directed, above all, towards acquiring empirical knowledge of the current state of development of local development initiatives (abbr. LDIs) of citizens and civil sector representatives in rural communities in the Republic of Serbia. The results can be used by academia, practitioners and representatives of all levels of government, especially local government, in directing future rural development policies

Research background: Leader approach and local development initiatives

The Leader approach is the only approach to endogenous, multi-sectoral, inter-territorial and integrated rural development, in which LDIs and local stakeholders, through bottom-up and local partnerships, play a key and central role in planning, designing and implementing local development strategies (EC, 2017; EC, 2006; ENRD, 2020). Its proper application in EU countries has positively affected the development and the process of managing rural development in general, thus improving the quality of life in these areas, diversifying the rural economy and advancing social capital, social and cultural innovation (Dargan & Shucksmith, 2008; EC, 2017; Esparcia Perez, 2000; EU, 2021; EU 2013; Konečný, 2019; Nieto Masot, Cárdenas Alonso & Costa Moreno, 2019; Ray, 2000).

In the current transition budget period, this approach is a mandatory component of the national and regional European Union's Rural Development Programs, funded through the European Agricultural Fund for Rural Development (abbr. EAFRD) (EU, 2020). The new, modernized and reformed CAP 2023-2027 brings no change, given that the CAP regulation states that "LEADER should therefore be continued in the future and its application should remain compulsory with a minimum allocation under the EAFRD" (EU, 2021, p. 16).

Although it is indisputable that strong institutions, decentralization, interaction between local, regional and central administration, as well as partnerships of civil, private and public sector are the basis for successful implementation of the Leader approach, it is important to emphasize the importance of knowledge and initiatives of citizens, civil society representatives, i.e. social entrepreneurs to promote local development based on an endogenous approach, reduce poverty, and improve the level and quality of life in local communities (Coffey & Polese, 1985; Klein, Fontan & Tremblay, 2009; Vázquez-Barquero & Rodríguez-Cohard, 2016).

In the Republic of Serbia, leader approach, as a national measure of rural development, is under the authority of the Ministry of Agriculture, Forestry and Water Management. For a long time, the incomplete regulatory and planning framework has prevented the implementation of the Leader measure, thus having a disincentive effect on local stakeholders (Bogdanov, et al., 2018; Paraušić & Bekić Šarić, 2021; State Audit Institution, 2020). At present, the Leader measure is completely defined in legal, strategic and program documents. However, the authors of this paper, as well as numerous of other authors believe that the necessary preconditions for proper implementation of the Leader measure are missing, especially bearing in mind lack of regional and local initiatives and networking of local stakeholders in creating and implementing local development strategies; low level of trust, knowledge and experience of the rural population on local initiatives and institutionally organized cooperation; low human resources capacities in local administration, politicization and bureaucratic approach in directing local development; difficult access to sources of funding at the local level and the like (Bogdanov, et al., 2018; Djukić, Volić, Tišma & Jelinčić, 2014; Janković Milić, Stanković & Marinkovic, 2014; Janković, 2012; Kotevska & Martinovska Stojcheska, 2015; Paraušić & Domazet, 2018; Rodriguez, 2010; Vujicic, Ristic & Ciric, 2013). In this paper authors will try to confirm or reject these opinions through answering the defined research questions.

Material and methods

The research is based on qualitative semi-structured interviews with acceptance of the semi-structured interview guide developed by Kallio, Pietilä, Johnson and Kangasniemi (2016). The survey covered licensed agricultural advisors employed in all Agricultural Advisory and Expert Service (abbr. AAES) in Serbia (total of 35), which operate as companies founded by the Republic of Serbia.

The sample included 118 licensed agricultural advisors distributed by regions as follows: Beograd (11), Juzna i istocna Srbija (27), Kosovo i Metohija (5), Sumadija i zapadna Srbija (34) and the Vojvodina (41). Territorially, the sample is equal to the spatial representation of the licensed agricultural advisories in the Republic of Serbia (Djurić, 2020), and the sample size represents 57% of the total number of advisors employed in AAES (Decree on determining the annual program for the development of advisory services in agriculture for 2022).

The selection of advisors is the result of simple random sampling, and the interviews cover the period from June to December 2021, through personal contact and by phone. All licensed agricultural advisors involved in the research answered the questions and expressed huge desire to share their knowledge from practical work with researchers.

Authors selected the licensed agricultural advisors as research participants because we assumed that they know well the socio-economic resources and problems of local rural communities, where they have obligations or jurisdiction to provide advisory services, in accordance with the Law on agricultural advisory and professional activities (2010, Article 2). Also, the authors believed that agricultural advisors would have greater objectivity and impartiality in relation to other local stakeholders.

Two variables were examined in rural communities of the Republic of Serbia: (1) State of local development initiatives and (2) Quality of life adapted to the needs of young people. The first variable is defined as a scope of joint, networked and planned initiatives of local stakeholders, primarily citizens and civil society representatives, aimed at sustainable development and improving the quality of life in rural communities, while the second variable indicates the labor market situation (employment of young people, women and highly-educated staff and/or development of one's own business), proximity, i.e. access to larger, urban centers, as well as the level of development of physical and social infrastructure and services in rural communities.

Respondents evaluated the analysed variables descriptively, as well as quantitatively on a scale from 1 to 5 (where a score of 1 indicates the least favourable condition of the examined variable and a score of 5 the most favourable condition). Advisors scored variables only in rural settlements where they have a legal obligation to provide advisory services, and since Republic of Serbia does not have an official definition of rural areas, they were asked to follow the OECD definition of rurality in the typology of settlements, according to which "*rural settlements (NUTS 5 level) are considered to be those with a population density below 150 inhabitants/km*^{2}" (Bogdanov, 2007, p. 39).

For the purposes of inference, the authors defined range of average score of the answers for both variables and gave description of variables for every range (*Table 1.*).

Table 1. Range of the average values of responses and their meaning by analysed variables

Range of average score	Analysed variables	Descriptive expression of variables
1.0-1.5	State of local development initiatives	Underdeveloped local initiatives
	Quality of life adapted to the needs of young people	Quality of life is not adapted to the needs of young people
1.6-2.5	State of local development initiatives	Low capacity of local development initiatives
	Quality of life adapted to the needs of young people	Quality of life slightly adapted to the needs of young people
2.6-3.5	State of local development initiatives	Moderate capacity of local development initiatives
	Quality of life adapted to the needs of young people	Quality of life moderately adapted to the needs of young people
3.6-4.5	State of local development initiatives	Strong capacity of local development initiatives
	Quality of life adapted to the needs of young people	Quality of life well adapted to the needs of young people
4.6-5.0	State of local development initiatives	Extremely strong capacity of local development initiatives
	Quality of life adapted to the needs of young people	Quality of life highly adapted to the needs of young people

Source: Author's presentation.

The semi-structured in-depth interview consisted of several units, and only part of the collected data was used for the purposes of this paper.

Primary quantitative data collected in the empirical research was processed in the statistical program IBM SPSS Statistics 26. For the purposes of inference, descriptive statistics, one-way analysis of variance (ANOVA), as well as Pearson's correlation coefficient were used. In addition, the presentation of qualitative answers related to the assessment of the state of local development initiatives in rural areas by agricultural advisers significantly improved and enriched the research results.

Results and discussion

Agricultural advisors' perceptions regarding to state of the LDIs and quality of life adapted to the needs of young people in the rural communities of the Republic of Serbia are presented in Table 2 and Figure 1. Those results provide an opportunity to answer the first research question. Namely, the mean value of the responses of the variable "State of the LDIs in rural communities" indicate the moderate capacity of LDIs (mean 3.2), which are much more positive and optimistic results compared to the research conducted by Bogdanov (2007) and Janković (2012). Observed by region (NUTS 2), mean value of variable is in a range of 3.0-3.6, and only in Kosovo and Metohija region advisers assessed strong capacity of LDIs.

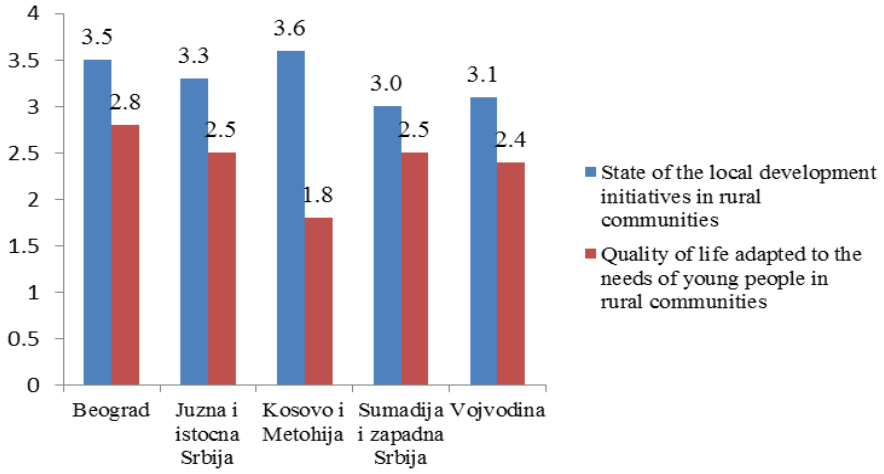
At the same time, data in the Table 2 and Figure 1 indicates that quality of life in rural communities is slightly adapted to the needs of young people (Mean 2.4), and also the same result was obtained for all regions except Belgrade region.

Table 2. Descriptive statistics of the agricultural advisors' answers for analysed variables on a scale of 1-5

Indicators	State of the local development initiatives in rural communities	Quality of life adapted to the needs of young people in rural communities
N	118	118
Missing	0	0
Mean	3.2	2.4
95% Confidence Interval for Mean	3.0-3.4	2.3-2.6
Median	3.0	2.0
Variance	0.913	0.822
Coefficient of variation (CV)	29.85%	37.78%
Std. Deviation	0.9552	0.9067
Minimum	1.0	1.0
Maximum	5.0	5.0
Range	4.0	4.0
Q1	3.0	2.0
Q3	4.0	3.0
IQR	1.0	1.0
Skewness	-0.388	0.311
Kurtosis	-0.270	-0.090

Source: Author's calculations.

Figure 1. Mean of the agricultural advisors' answers on a scale of 1-5



Source: Author's calculations.

Authors used one-way analysis of variance for response to the second research question, and in order to determine the existence of statistically significant difference in the agricultural advisors' perceptions of the state of LDIs in the rural communities by the regions of the Republic of Serbia. At the significance level of 0.05, the authors concluded that there is no statistically significant difference in the agricultural advisors' perceptions of the state of LDIs observed by regions (Table 3.).

Table 3. State of the local development initiatives in rural communities by NUTS 2 region: results of the ANOVA application

Source of variation	**Df**	**Sum of squares (*SS*)**	**Mean square (*MS*)**	***F* value**	**Sig.**
Between groups	4	SS_A = 4.642	MS_A = 1.160	1.284	.281
Residuals (within groups)	113	SS_R = 102.121	MS_R = .904		
Total	117	106.763			

Source: Authors' calculations. IBM SPSS Statistics 26

Having in mind that the regions in the Republic of Serbia differ by the level of economic development (measured by the value of gross domestic product per capita[5]), the presented results suggest that state of the LDIs in rural communities isn't relate to the stage of economic development of the region.

Table 4. Correlations between State of the local development initiatives (LDIs) and Quality of life adapted to the needs of young people in rural communities

		State of the LDIs	Quality of life adapted to the needs of young people
State of the local development initiatives in rural communities	Pearson Correlation	1	.462**
	Sig. (2-tailed)		.000
	N	118	118
Quality of life adapted to the needs of young people in rural communities	Pearson Correlation	.463**	1
	Sig. (2-tailed)	.000	
	N	118	118
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: Authors' calculations. IBM SPSS Statistics 26

5 Based on the Regulation on establishing a unified list of development of regions and local self-government units for 2014 (Official Gazette of RS No. 104/2014), the Belgrade region and the region of Vojvodina are classified as developed regions, as regions with gross domestic product above the national average, while underdeveloped regions are the region of Šumadija and Western Serbia, the region of Southern and Eastern Serbia and the region of Kosovo and Metohija, as regions in which the value of gross domestic product is below the value of the national average.

The answer to the third research question, regarding agricultural advisors' perceptions of the possible correlation between both analysed variables (direction and strength of the correlation), is given in Table 4. Results showed a moderate positive correlation (r=0.470) between two variables, according to range of values of the Pearson correlation coefficient (Profillidis & Botzoris, 2018).

Regarding the qualitative assessments of the state of the local development initiatives in rural communities, licensed agricultural advisors are almost unanimous in their views that local initiatives of citizens and civil society representatives exist only when it comes to the need to solve problems (acute or long-standing), while there are almost no long-term initiatives or initiatives to improve the situation in the local community. This is in line with the findings of the group of authors that most local initiatives are "short-term and ad-hoc in nature" (Djukić, Volić, Tišma & Jelinčić, 2014, p. 56). Changes in the local community are most often initiated by young people, informal groups of citizens or registered farmers' associations. According to the respondents, the inhabitants of rural areas are increasingly informed, interested in their progress and improving the quality of life in the areas in which they live, they know their rights, as well as the procedures for their realization.

Local initiatives are primarily present in the segment of improving the situation in the field of physical, i.e. communal infrastructure (water supply and sewerage network), energy (electricity, gas) and road infrastructure. In addition, initiatives to build or improve agricultural infrastructure (arrangement of rural roads, irrigation/drainage canals, and support for hail protection) are highlighted. Our results confirm the research by a group of authors who also point out that "infrastructure development is an important prerequisite for economic diversification and socio-cultural development, which should in turn provide a better standard of living" (Vujicic, Ristic & Ciric, 2013, p. 123). On the other hand, although "rural vitality is composed of economic, social and cultural dimensions" (Vujicic, Ristic & Ciric, 2013, p. 123), our results indicate that there are insufficient initiatives to address social infrastructure (investment in schools, kindergartens, cultural centers, health institutions, construction/reconstruction of sports fields and playgrounds) and improve cultural, educational, health and sports services and facilities, as well as initiatives in the field of landscaping, parks, sidewalks, pedestrian paths, cleaning public spaces and the like. There is also a lack of initiatives by agricultural producers to build cold stores, storage facilities and the like together and using joint funds in order to improve their market position and ensure better marketing of their products. Even where these types of farmers' initiatives do exist, they remain only "on paper", because they lack financial resources for the realization of planned investments.

The results show that the following factors largely demotivate the LDIs of citizens and the civil sector: (1) the slowness of decision-making on the implementation of certain projects, as well as the long period of implementation of ongoing projects; (2) complicated bureaucratic administrative procedures; (3) lack of financial resources for project implementation, as well as (4) significantly strong policy influence in all spheres of local government. These results are in line with research by other authors,

who point to obstacles to rural development through local and/or regional initiatives in the form of polarized and bureaucratic structures of local self-government, which do not contribute to the improvement of the business environment, nor encourage the formation and operation of local partnerships (Bogdanov, et al., 2018; Cañete, Navarro & Cejudo, 2018; Esparcia Perez, 2000; Janković Milić, Stanković & Marinkovic, 2014; Janković, 2012; Navarro, Woods & Cejudo, 2016).

As the biggest limitations of the research, the authors state the following: inclusion of only one group of stakeholders (agricultural advisors) in the research, their subjective attitude in the evaluation of analyzed variables which is typical for social research (Shipman, 2014), as well as a small number of employed advisory workers in the Belgrade region (only one registered AAPS with 15 advisors employed) and the region of Kosovo and Metohija (only one AAPS based in Kosovska Mitrovica with 5 employed advisors). However, having in mind the size of the sample, impartial, objective and expertise- and experience-based perception of advisors, as well as the fact that there is no research of this kind in domestic literature, the authors believe that this research provides useful knowledge of current state of LDIs in rural communities of the Republic of Serbia.

In the following papers, the authors will try to examine other features of rural areas, especially the state of social capital development, with the expansion of the scope of respondents to other participants and decision makers in rural development, such as: local government representatives, local economic development office, representatives of the business sector and the like.

Conclusion

Assuming that, among other factors, local initiatives and "bottom up" approach are necessary prerequisites for effective and correct implementation of the Leader approach to rural development, the authors investigated the current state of local development initiatives of citizens and civil society representatives in the rural areas of the Republic of Serbia and their connection with the quality of life in these areas. The analysis was based on the perceptions of 118 agricultural advisors, involved in the research through an in-depth semi-structured interview, which was conducted in 2021.

The results show moderately capacity of local development initiatives of citizens and civil sector representatives (mean 3.2 on a scale of 1-5), from the point of view of agricultural advisers. Observed by region, all regions have the same lavel of local development initiatives, except for the region of Kosovo, where agricultural advisers assessed strong capacity of local development initiatives. Using one-way analysis of variance, the authors concluded that there are no statistically significant differences in the agricultural advisers' perceptions of capacities of local development initiatives by NUTS 2 regions, which means that different characteristics of regions (natural, social) and different levels of their economic development, do not affect agricultural advisers' perceptions. The correlation analysis pointed a moderate positive correlation (r=0.470) between the quality of life

and capacity of local development initiatives in rural communities, so we may conclude that conditions and quality of life in rural areas are not in significant connection with the capacities of local development initiatives and vice versa.

Results suggested that, in the coming period, central, regional and local levels of government must undertake planning activities (educational, promotional, and financial) to empower and encourage local capacities and ensure the successful implementation of the Leader measure. Also, article can provide guidance to policy makers at all levels (especially at the level of local governments) in directing future local rural development policy, in order to strengthen capacities and strengthen local development initiatives, as important prerequisites for effective implementation of Leader measures and the use of EU pre-accession funds for rural development.

Acknowledgement

This research was financially supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Contract No. 451-03-68/2022-14 and Contract No. 451-03-68/2022-14/200109). Also, authors would like to thank agricultural advisers who were willing to take part in this survey.

Conflict of interests

The authors declare no conflict of interest.

References

1. Babović, M. (2022). *Do not leave anyone out of development. Spatial aspects of sustainable development: differences by type of settlement and between regions*. Belgrade, Serbia: Statistical Office of the Republic of Serbia.
2. Babović, M. (2020). *Progress report on the implementation of sustainable development goals by 2030 in the Republic of Serbia.* Belgrade, Serbia: Statistical Office of the Republic of Serbia.
3. Bogdanov, N., Leveska Gjorshoska, B., Palazzo, A., Gjorgievski, P. & Lukesch, R. (Eds.). (2018). *Application of the LEADER Approach in the Western Balkan Countries - "from a local initiative to a mainstream concept in the rural areas"*. Skopje: Regional Rural Development Standing Working Group in SEE (SWG)
4. Bogdanov, N. (2007). *Small rural households in Serbia and rural non-farm economy*. Belgrade, Serbia: UNDP.
5. Cañete, J. A., Navarro, F., & Cejudo, E. (2018). Territorially unequal rural development: the cases of the LEADER Initiative and the PRODER Programme in Andalusia (Spain). *European Planning Studies*, *26*(4), 726-744. doi: 10.1080/09654313.2018.1424118
6. Cizler, J. (2013). Opportunities for the sustainable development of rural areas in Serbia. *Problemy Ekorozwoju–Problems of Sustainable Development*, *8*(2), 85-91.

7. Coffey, W. J., & Polese, M. (1985). Local development: Conceptual bases and policy implications. Regional studies, 19(2), 85-93.
8. Dargan, L., & Shucksmith, M. (2008). LEADER and innovation. *Sociologia ruralis*, *48*(3), 274-291. doi: 10.1111/j.1467-9523.2008.00463.x
9. Decree on determining the annual program for the development of advisory services in agriculture for 2022. [*in Serbian*: Уредба о утврђивању годишњег програма развоја саветодавних послова у пољопривреди за 2022. годину].
10. Djukić, V., Volić, I., Tišma, S., & Jelinčić, D. A. (2014). Responsible community based ecotourism initiatives in protected rural areas of the Balkans: Case studies from Serbia and Croatia. *American Journal of Tourism Management*, *3*(1B), 51-63. doi: 10.5923/s.tourism.201402.06
11. Djurić, K. (2020). State and perspectives of *of agricultural advisory* in the Republic of Serbia. Novi Sad: Faculty of Agriculture, University of Novi Sad. *[in Serbian:* Djurić, K. (2020), Stanje i perspektive poljoprivrednog savetodavstva u Republici Srbiji.].
12. EC (2017). *Guidelines. Evaluation of LEADER/CLLD*. European Evaluation Helpdesk for Rural Development. Brussels August, 2017
13. EC (2006). *The Leader approach*. A basic guide. Luxembourg: Office for Official Publications of the European Communities
14. ENRD (2020). *Leader achievements*. EU Rural Review, No 29, Luxembourg: Publications Office of the European Union, 2020
15. Esparcia Perez, J. (2000). The LEADER programme and the rise of rural development in Spain. *Sociologia Ruralis*, *40*(2), 200-207. doi: 10.1111/1467-9523.00142
16. EU (2021). Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013. Official Journal of the European Union, L 435, 6 December 2021
17. EU (2020). REGULATIONS REGULATION (EU) 2020/2220 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 December 2020 laying down certain transitional provisions for support from the European Agricultural Fund for Rural Development (EAFRD) and from the European Agricultural Guarantee Fund (EAGF) in the years 2021 and 2022 and amending Regulations (EU) No 1305/2013, (EU) No 1306/2013 and (EU) No 1307/2013 as regards resources and application in the years 2021 and 2022 and Regulation (EU) No 1308/2013 as regards resources and the distribution of such support in respect of the years 2021 and 2022. Official Journal of the European Union L 437

18. EU (2013). Regulation (EU) No 1305/2013 of the European Parliament and of the Council of 17 December 2013 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and repealing Council Regulation (EC) No 1698/2005. Official Journal of the European Union L 347.
19. Ilić, B., Pavloska Gjorgjieska, D. & Ciaian, P. (Eds.). (2019). *Agricultural policy developments and EU approximation process in the Western Balkan countries.* Luxembourg: Publications Office of the European Union, doi:10.2760/583399
20. Janković Milić, V. Stanković, J., & Marinkovic, S. (2014). The capacity of local governments to improve business environment: Evidence from Serbia. *Proceedings of Rijeka Faculty of Economics, Journal of Economics and Business*, *32*(2), 233-254.
21. Janković, D. (2012). Territorial approach to regional rural development. *Economics of Agriculture, 59(4).*
22. Joldžić, V., Batrićević, A., Stanković, V., & Paunović, N. (2019). Solving the Problems of Rural as Environmentally Desirable Segment of Sustainable Development. *Economic Analysis*, *51(1-2),* 79-91. doi: 10.28934/ea.18.51.12
23. Kallio, H., Pietilä, A. M., Johnson, M., & Kangasniemi, M. (2016). Systematic methodological review: developing a framework for a qualitative semi-structured interview guide. *Journal of advanced nursing*, *72*(12), 2954-2965
24. Klein, J. L., Fontan, J. M., & Tremblay, D. G. (2009). Social entrepreneurs, local initiatives and social economy: foundations for a socially innovative strategy to fight against poverty and exclusion. *Canadian Journal of Regional Science*, *32*(1), 23-42.
25. Konečný, O. (2019). The leader approach across the European Union: one method of rural development, many forms of implementation. *European countryside, Vol. 11 (1),* 1-16
26. Kotevska, A. & Martinovska Stojcheska, A. (Eds.). (2015). *The Impact of Socio-Economic Structure of Rural Population on Success of Rural Development Policy. Macedonia, Serbia and Bosnia and Herzegovina*. Skopje: Association of Agricultural Economists of Republic of Macedonia.
27. Law on agricultural advisory and professional activities. Official Gazette of RS No. 30/2020. [*in Serbian*: Закон о обављању саветодавних и стручних послова у области пољопривреде, Службени гласник РС, број 30/2010].
28. Navarro, F. A., Woods, M., & Cejudo, E. (2016). The LEADER initiative has been a victim of its own success. The decline of the bottom-up approach in rural development programmes. The cases of Wales and Andalusia. *Sociologia Ruralis*, *56*(2), 270-288. doi: 0.1111/soru.12079
29. Nieto Masot, A., Cárdenas Alonso, G., & Costa Moreno, L. M. (2019). Principal component analysis of the Leader approach (2007–2013) in South Western Europe. *Sustainability, 11(15), 1-15*. doi:10.3390/su11154034

30. Paraušić, V. & Bekić Šarić, B. (2021). Implementation of the Leader approach in Serbia: experiences and results. In J. Subić, P. Vuković & J.V. Andrei (Eds.), Sustainable Agriculture and Rural Development (pp. 345-352). Belgrade, Serbia: Institute of Agricultural Economics.
31. Paraušić, V., & Domazet, I. (2018). Cluster development and innovative potential in Serbian agriculture. *Економика пољопривреде*, *65*(3), 1159-1170, doi:10.5937/ekoPolj1803159P
32. Popović, V., Katić, B., & Savić, M. (2011). Rural development in Serbia and local communities. *Ekonomika poljoprivrede*, *58*(1), 33-44. [*in Serbian*: Popović, V., Katić, B., & Savić, M. (2011), Ruralni razvoj u Srbiji i lokalne zajednice].
33. Popescu, G., & Andrei, J. (2011). From industrial holdings to subsistence farms in Romanian agriculture. Analyzing the subsistence components of CAP. *Agricultural Economics*, 57(11), 555-564.
34. Popescu, G. H., Nicoale, I., Nica, E., Vasile, A. J., & Andreea, I. R. (2017). The influence of land-use change paradigm on Romania's agro-food trade competitiveness—An overview. *Land Use Policy*, 61, 293-301.
35. Profillidis, V. A. & Botzoris, G. N. (2018). Modeling of transport demand – analyzing, calculating, and forecasting transport demand. Amsterdam, Elsevier, 2018, 472.
36. Radukić, S., Petrović-Ranđelović, M., & Kostić, Z. (2019). Sustainability-based goals and achieved results in Western Balkan countries. *Economics of Sustainable Development*, *3*(1), 9-18.
37. Ray, C. (2000). The EU LEADER programme: rural development laboratory. Sociologia ruralis, 40(2), 163-171.
38. Regulation on establishing a unified list of development of regions and local self-government units for 2014, Official Gazette of RS No. 104/2014. [*in Serbian:* Уредба о утврђивању јединствене листе развијености региона и јединица локалне самоуправе за 2014. годину, Службени гласник РС, бр. 104/2014].
39. Rodriguez, J. P. (2010). Sustainable initiatives in marginal rural areas of Serbia: a case study of Dimitrovgrad municipality. *Applied Studies in Agribusiness and Commerce – APSTRACT,* Vol. 4 No 5-6, 7-13
40. Shipman, M. D. (2014). *The limitations of social research*. Routledge. London.
41. State Audit Institution (2020). Business Performance Audit Report. Incentives for rural development measures. [*in Serbian: Izveštaj o reviziji svrsishodnosti poslovanja. Podsticaji merama ruralnog razvoja*].
42. Strategy of Agriculture and Rural Development of the Republic of Serbia 2014–2024, Official Gazette of RS No. 85/2014. [*in Serbian*: Стратегија пољопривреде и руралног развоја Републике Србије за период 2014-2024. година, Службени гласник РС, бр. 85/2014].

43. United Nations (2015). *Transforming our world: the 2030 Agenda for Sustainable Development*. General Assembly. United Nations, 21 October 2015, A/RES/70/1.

44. Vázquez-Barquero, A., & Rodríguez-Cohard, J. C. (2016). Endogenous development and institutions: Challenges for local development initiatives. Environment and Planning C: Government and Policy, 34(6), 1135-1153.

45. Vujičić, M., Ristić, L., & Ćirić, N. (2013). Local Initiatives for Rural Vitality and Social Inclusion: Some Experiences from Serbia. *Eastern European Countryside*, *19*, 105-126. doi: 10.2478/eec-2013-0006

46. Živojinović, I., Ludvig, A., & Hogl, K. (2019). Social innovation to sustain rural communities: Overcoming institutional challenges in Serbia. *Sustainability*, *11*(24), 7248. doi:10.3390/su11247248

THE DEVELOPMENT OF COUNTRYSIDE WALKING TOURISM IN THE TIME OF THE POST-COVID CRISIS

Danka Milojković[1], Milena Nikolić[2], Katarina Milojković[3]

**Corresponding author E-mail: dmilojkovic@singidunum.ac.rs*

ARTICLE INFO

Original Article

Received: *04 August 2022*

Accepted: *25 October 2022*

doi:10.59267/ekoPolj2301131M

UDC 338.48-44(1-22):796.5
616-036.21:578.834

Keywords:

countryside, walking, tourism, rural, policy, post-covid

***JEL**: O13, Z32, Q01*

ABSTRACT

With low investment, countryside walking tourism contributes to the rapid recovery of rural tourism in the post-covid time. The research purpose is to examine factors that impact the interest of tourists in the state-supported countryside walking tourism. The sample consisted of 467 respondents from the general public. The SPSS software was used for processing data. The results indicated that safety, content, and price are the most influential factors. For females, slightly more important factors were related to the possibility of consuming authentic food and beverages, buying traditional handmade products, the inclusion of the local population, and the well-being of urban residents. A village, with authentic local houses and cuisine, and local tour guides, are the epicenter of countryside walking tourism. Embedding countryside walking tourism in sustainable rural tourism development policies is recommended. The research contributes to the integration between sustainable rural development and sustainable tourism development.

Introduction

One of the most vibrant industries in the world is tourism due to the continual and dedicated focus of countries worldwide on developing their local characteristics and natural resources, especially in the rural areas, and planning to increase the number of tourists and duration of stay to create the higher value (Lin et al., 2022). In the 1970s-‘80s, rural tourism grew in many parts of the world, describing rural tourism through rural tourism activities (Silva, 2022).

1 Danka Milojković, Assistant Professor, Singidunum University, 32 Danijelova Street, 11000 Belgrade, Serbia, Phone: +381655207121, E-mail: dmilojkovic@singidunum.ac.rs, ORCID ID (https://orcid.org/0000-0002-4434-9576)

2 Milena Nikolić, Assistant Professor, Singidunum University, 32 Danijelova Street, 11000 Belgrade, Serbia, Phone: +38162433158, E-mail: milena.nikolic@singidunum.ac.rs, ORCID ID (https://orcid.org/0000-0002-8665-0738)

3 Katarina Milojković, Student, Singidunum University, 32 Danijelova Street, 11000 Belgrade, Serbia, Phone: +38160351211, E-mail: katarina.milojkovic.21@singimail.rs, ORCID ID (https://orcid.org/0000-0001-8658-8973)

Due to the heterogeneity of characteristics, rural tourism is not uniquely defined and there is no single tourism model, and most researchers support the concept of sustainable rural tourism development based on Sustainable Development Goals (hereinafter SDG) (Polukhina et al., 2021). Bearing in mind that the SDG requires creativity, knowledge, technology, and financial resources, the United Nations adopted 17 SDGs in 2015 to launch global activities to end poverty, protect the planet and ensure world peace and prosperity by 2030 (United Nations Development Programme, 2022). In 12 countries around the world, tourism is linked to SDG 11 on *Sustainable Cities and Communities* and they agree that tourism affects the renewal of traditional villages, the promotion of quality products, and the development of short supply chains and local markets, for more efficient and effective access of small producers to market (WTO & UNDP, 2017). The research in the Stavropol region shows that the parallel development of the agricultural sector and non-agricultural sector, such as the development of rural tourism, contributes to increasing the employment rate in rural areas in Russia (Ivolga & Shakhramanian, 2019). "The total impact of rural tourism in European rural areas exceeds 65 billion euros"(Štetić, Šimičević, 2017, p. 65). The importance of rural tourism, viewed from the aspect of the problem of environmental pollution, distance of people from nature, standardization, and uniformity in modern lifestyle, is reflected in the growing interest of people to return to nature and a healthy lifestyle (Vujović et al., 2012). After the pandemic, the importance of rural tourism is greater in terms of which it contributes to preserving and improving human health, as well as the possibility of rapid recovery of tourism, „as a complementary activity that will complement agriculture as the main activity" (Štetić, Šimičević, 2017, p. 64) of the rural area.

Although the impact of the covid-19 pandemic on the development of rural tourism has been insufficiently researched, the findings of some studies indicate a positive impact of the pandemic on rural tourism, citing the need of tourists for a safer or less risky place due to smaller population, but the findings of certain studies showed that the impact of the pandemic is not uniform in surrounding (Silva, 2022). In the pre-pandemic period, the role of rural tourism was to relieve the stress of urban residents (Polukhina et al., 2021). During the anti-pandemic measures, people were isolated in apartments in the cities with limited walking and fear of pneumonia, while the post-pandemic period is characterized by the increased value of living in the countryside (Polukhina et al., 2021).

From the aspect of the population, cities and villages are inhabited by an equal number of people, but from the aspect of space, cities occupy 1 to 3% of the world's land mass (Landy, Moreau, 2015). The right to the city and the right to the village is the same thing, but "there is a risk that the right to the city might make many forget the countryside." (Landy, Moreau, 2015, pp. 18-19). Like the urban areas, the countryside areas have institutional management and administration. A village administration consists of village officials who include "all officials, employees, consultants, agents, and others who work for or with the Village at all times while on or in Village Property, whether on duty or off duty, and contractors and vendors, and their personnel, when engaged in work for or business with the Village" (Law Insider, 2022). "Creation of competitive and innovative

sector of agriculture cannot be imagined without strong connection of public and private sector, without strong connection of the state, education, science, consultants and farmers" (Cvijanović, 2009, p. 72). Taking into consideration the diversity of roles, perspectives, and personalities of elected officials and administrative staff, their cooperation in village management is a complicated process that requires clear legislation, goodwill, and teamwork for the village to function effectively (League staff, 2022). Agritourism allows farmers to increase their income from agriculture with income from countryside tourism if the village can attract tourists with its natural and cultural resources and completed facilities for providing good accommodation (Kurniasih et al., 2018).

For the last 60 years, donor countries have provided aid of approximately 100 billion USD annually and their official development assistance has had a key role in sustainable development despite the fact that the development aid has not yet achieved the expected results (Balaskas et al., 2009). In order to achieve sustainable development of rural areas, it is necessary to focus on activities based on local area development making maximum use of local resources and capacities of the local community, which is feasible if local entrepreneurs' strategies are part of micro-region strategic documents (Šimkova, 2007). The competitiveness of the agro-food sector relies on standards, agriculture, and ICT (Bešić et. al., 2021). A strategic approach to tourism development enables the realization of a continuous synergy of economic, social, and environmental benefits from the development of tourism in a certain location and thus creates conditions for achieving a better quality of life and prosperity (Popesku, 2016). Local authorities in Western Europe look at rural tourism, as a key driver of local development, and under the EU's Leader Programme, 900 local action groups were launched wherefrom more than 70% promote tourism and the use of local heritage (Euracademy, 2003). Based on the research on a random sample of four tourist facilities that use the natural resources in the Republic of Srpska, a multi-criteria model can apply to the assessment of current and potential rural tourist capacities (Nedeljković et. al., 2022). The development of rural tourism should be based on entrepreneurial projects that include innovative food products (Čavić et. al., 2020). Due to the negative impacts of traditional agricultural production on the environment, "organic farming can be considered sustainable" (Tomaš Simin et. al., 2019, p. 274), and "the typical buyers of organic food are mostly female, with higher education and income, from the urban environment, and older age" (Mitić & Čolović, 2022, p. 360).

Rural tourism is a concept that includes various forms of tourism: ecotourism, rural tourism, agro-tourism, adventure tourism, and equestrian tourism (Ayazlar & Ayazlar, 2015). The mentioned forms of tourism include food and wine as the main motivation for visiting a rural destination (Ayazlar & Ayazlar, 2015). Walking is a universal tourist activity in all forms of tourism (Davies, 2018). Walking tourism refers to walking in nature, specifically in a rural area (Molgo & Etfi, 2021). "According to a survey by the English Tourist Board, 80% of tourists go on walks during their holiday without considering themselves "walkers"" (Kouchner & Lyard, 2001, p. 9). The development of walking tourism is an excellent investment since from the 1.38 euros investment,

almost 18 euros income is earned (Molgo & Etfi, 2021). Due to the fact that "tourists are spreading around the village in concentric circles until they "lose" energy" (Štetić, Šimičević, 2017, p. 63) and "a large number of villages are located near valuable cultural and historical monuments" (Borović et. al., 2022, p. 930), there is a need for the development of countryside walking tourism.

An active holiday is a trip outside the usual environment to participate in sports activities and maintain physical and mental health; it can include elements of relaxation, spa and wellness services, and healthy food (Halminen, 2019). Walking as a slow physical activity feasible without special equipment, facilities, and training, with clear health, environmental, economic, and social benefits, in the context of tourism contributes to the achievement of tourist destination competitiveness starting with the number of available footpaths and attractiveness of the route such as opportunities to enjoy nature, culture, and landscape (Simeoni & De Crescenzo, 2019). Not using vacation days contributes to the lack of communication or the inability to communicate with other people, creating social problems and social exclusion, whereas the use of vacations contributes to the quality of life and well-being of children and families as a whole (Quinn & Stacey, 2010). A family holiday, as a way to escape from hectic everyday life, is a way to relieve stress through family companionship contributing to the creation of moments where all family members are satisfied (Gram, 2005).

In order to determine the importance of state-based countryside walking tourism development, a basic hypothesis was that state-supported countryside walking tourism influences the interest of tourists because of safer stay, better content, and more affordable prices (H1). The following working hypotheses were set: there are differences in the thinking of the females and males regarding the factors that influence the interest of tourists in the state-supported countryside walking tourism (H2); there are differences according to age, marital status, number of children, education, work status, and annual personal investment for tourist travel and vacation regarding the factors that influence the interest of tourists in the state-supported countryside walking tourism (H3); villages and local populations are meaningful for the development of countryside walking tourism (H4); tourists choose authentic local cuisine and authentic local house on their trip and active vacation (H5); the role of local guides is significant for the countryside walking tourism development (H6).

Materials and Methods

The data was collected using the questionnaire prepared according to the method of closed-ended multiple-choice questions (Simeoni & De Crescenzo, 2019). The questionnaire was distributed to the general public using academic and social networks. The 467 questionnaires were collected from March 20th to May 2nd, 2022, and used for the research. The data were processed by SPSS software (version 16). The t-test and the Kruskal-Wallis H Test were used for the precise indication of statistically significant differences according to gender, and by age, marital status, number of children, education, work status, and annual personal investment for tourist travel and vacation respectively.

Results and Discussions

After the survey was conducted, applying the descriptive statistical analysis the authors observed that the majority of respondents were female (66.4%), compared to male (33.6%). In the age structure, the dominant group of respondents belonged to the age group from 36 to 55 years (52.9%) in relation to groups younger than 35 years (29, 2%) and older than 56 years (18.0%). More than half of the respondents (51%) were married, while 26.8% were single, 13.1% were cohabitation, and 9.2% were divorced and widowed. The majority of respondents (61.0%) had children, whereas 39.0% were childless. There were mostly (66.4%) university-educated respondents followed by (19.7%) respondents with secondary education and (12.8%) college, whereas 1.0% of respondents accounted with non-formal and primary education. According to the work status, numerous respondents were (69.9%) employed, (21.6%) unemployed, (6.4%) retired, and (2.1%) other.

Depending on the available funds that the respondents are willing to spend for their tourist trip and vacation (Table 1).

Table 1. Descriptive statistics for the annual personal investment in tourist trip and vacation

Value label	Frequency	Percent
<500 euros	180	38.5
500-1000 euros	159	34.0
>1000 euros	128	27.4
Total	467	100.0

Source: Authors' calculations

38.5% of respondents were ready to annually invest in tourist trip and vacation less than 500 euros, 34.0% of respondents from 500 to 1,000 euros, and 27.4% more than 1,000 euros.

The research examined the type of food that tourists most often consume on their trip or active vacation (Table 2).

Table 2. Descriptive statistics for the type of food consuming on the trip and active vacation

Value label	Frequency	Percent
self-prepared food	167	35.8
restaurant food	35	7.5
fast food	9	1.9
authentic local cuisine	256	54.8
Total	467	100.0

Source: Authors' calculations

The majority of respondents (54.8%) chose authentic local cuisine, followed by (35.8%) self-prepared food, (7.5%) restaurant food, and (1.9%) fast food.

For the purposes of the research, it was examined the type of accommodation tourists most often use on their trip or active vacation (Table 3).

Table 3. Descriptive statistics for the type of accommodation on the trip or active vacation

Value label	Frequency	Percent
camping car	15	3.2
tent	28	6.0
hotel	93	19.9
hostel	6	1.3
apartment	86	18.4
authentic local house	239	51.2
Total	467	100.0

Source: Authors' calculations

On the trip and active vacation, respondents (51.2%) mostly chose to be accommodated at an authentic local house, then 19.9% of respondents chose a hotel, 18.4% apartment, 6.0% tent, 3.2% camping car, while the lowest number of respondents (1.3%) chose hostel. Since the research results indicated that the majority of respondents prefer choosing authentic local cuisine and authentic local house for accommodation, hypothesis H5 was confirmed.

Untouched nature is an extremely important factor in choosing a rural tourism destination. Accordingly, there were questions and processed results about the respondents' way of visiting and meeting untouched nature (Table 4).

Table 4. Descriptive statistics for the type of meeting with untouched nature

Value label	Frequency	Percent
using a map guide	112	24.0
using a certified tour guide from a commercial company	23	4.9
using a local tour guide with knowledge and experience in the area	332	71.1
Total	467	100.0

Source: Authors' calculations

The results indicated that the value of experienced local tour guides is of great importance (71.1%) confirming hypothesis H6. Also, 24.0% of respondents use a tourist map and 4.9% use the certified tour guide of a commercial company. The exceptional role of the local population in getting to know the areas visited by tourists is obvious.

As a part of the survey, the opinions of respondents were collected for the importance of villages and the influence of the local population on the rural area (Table 5).

Table 5. Descriptive statistics for the meaningful of the village and local population in rural areas

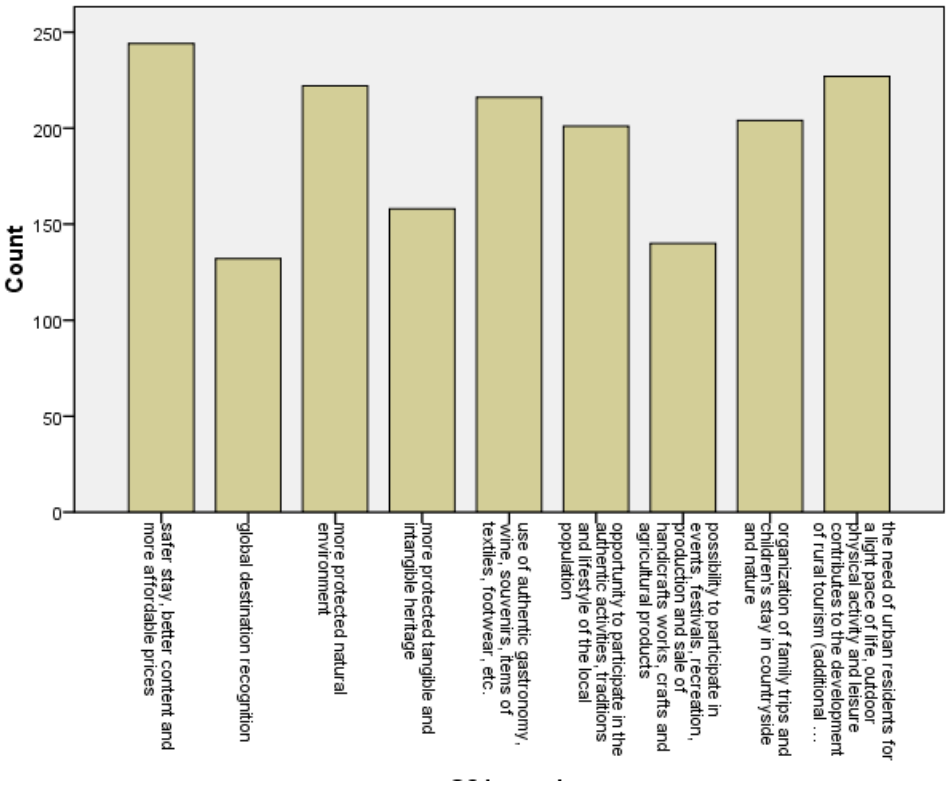
Value label	Frequency	Percent
no	336	71.9
yes	73	15.6
indifferent	58	12.4
Total	467	100.0

Source: Authors' calculations

The opinion of the majority of respondents (71.9%) was that villages and local populations are meaningful for rural areas which additionally confirms the importance and the role of villages and rural population in the development of countryside walking tourism as a form of rural tourism. In this regard, hypothesis H4 was confirmed.

The results of respondents' opinions on whether walking tourism in rural areas would be a part of the country's sustainable development strategy, and how it would influence the interest of tourists are shown in Figure 1.

Figure 1. The factors of state-supported countryside walking tourism on the interest of tourists



Source: Authors' calculations

The most frequent factor was "safer stay, better content, and more affordable prices" (I-1) supported by 244 (13.99%) respondents followed by factors: "the need of urban residents for a light pace of life, outdoor physical activity and leisure contribute to the development of rural tourism" (I-9), and "more protected natural environment" (I-3) supported by 227 (13.02%) and 222 (12.73%) respondents respectively. In addition, the following six factors were chosen by the respondents: "use of authentic gastronomy, wine, souvenirs, items of textiles, footwear, etc. " (I-5) 216 (12.38%), „organization of family trips and children's stay in countryside and nature" (I-8) 204 (11.70%), "opportunity to participate in the authentic activities, traditions, and lifestyle of the local population" (I-6) 201 (11.52%), "more protected tangible and intangible heritage" (I-4) 158 (9.06%), "possibility to participate in events, festivals, recreation, production and sale of handicrafts works, crafts, and agricultural products" (I-7) 140 (8.03%), and "global destination recognition" (I-2) 132 (7.57%) respondents. The results of descriptive statistics confirmed hypothesis H1 that if countryside walking tourism would be supported by the state, the most influential factor that would affect the interest of tourists would be related to safety, content, and price.

The research determined whether there is a difference in the thinking of women and men when it comes to factors of state-supported countryside walking tourism and their influence on the interest of tourists (Table 6).

Table 6. The results of the t-test and statistically significant differences by gender

	t-test for Equality of Means						
Factors of state-supported countryside walking tourism on the interest of tourists	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**	**95% Confidence Interval of the Difference**	
						Lower	**Upper**
I-1	1,378	465	,169	,06745	,04893	-,02870	,16361
I-2	,299	465	,765	,01321	,04420	-,07364	,10007
I-3	,320	465	,749	,01568	,04902	-,08065	,11200
I-4	,438	465	,662	,02032	,04644	-,07093	,11157
I-5	2,308	320,162	,022	,11146	,04829	,01646	,20647
I-6	2,328	324,544	,021	,11105	,04771	,01719	,20492
I-7	,228	465	,820	,01023	,04497	-,07814	,09861
I-8	1,913	321,380	,057	,09195	,04806	-,00260	,18649
I-9	2,637	318,094	,009	,12776	,04844	,03246	,22306

Source: Authors' calculations

Results of the t-test and Cohen's criteria for interpreting differences (Cohen, 1988, pp. 284-287) indicated small statistically significant differences for the following factors: I-5 between females (M=0.5000, SD=0.48898) and males (M=0.3885, SD=0.50081), t(320.162)=2.308, p=0.22, Mean difference 0.11, 95% CI: 0.02 to 0.21, eta square=0.011, meaning that the gender difference explains only 1.1% of

the variance of factor I-5; I-6 between females (M=0.4677, SD=0.49977) and males (M=0.3567, SD=0.48055), t(324.544)=2.328, p=0.21, Mean difference 0.11, 95% CI: 0.02 to 0.20 eta square=0.012, meaning that the gender difference explains only 1.2% of the variance of factor I-6; I-9 between females (M=0.5290, SD=0.49996) and males (M=0.4013, SD=0.49172), t(318.094)=2.637, p=0.09, Mean difference 0.13, 95% CI: 0.03 to 0.22, eta square=0.015, meaning that the gender difference explains only 1.5% of the variance of factor I-9. The results of the parametric technique t-test indicated existing small statistically significant differences in the thinking of female and male populations regarding the factors I-5, I-6, and I-9 that influence the interest of tourists in the state-supported countryside walking tourism, confirming the hypothesis H2. The mentioned factors are more important for females than for males. Based on these results, in the process of preparing policies for sustainable rural and tourism development, it is necessary to pay attention to the differences that exist between the female and male populations and create policies and programs "tailored" to the needs of the user groups.

The research showed the existence of significant differences in the perception of the factors of state-supported countryside walking tourism and their influence on the interest of tourists by the following grouping variables: age, marital status, number of children, education, work status, and annual personal investment for tourist travel and vacation (Table 7).

Table 7. Kruskal – Wallis test results

Factors of state-supported countryside walking tourism on the interest of tourists	**I-1**	**I-2**	**I-3**	**I-4**	**I-5**	**I-6**	**I-7**	**I-8**	**I-9**
Grouping Variable: Age									
Chi-Square	8,522	12,779	3,216	6,226	1,951	4,954	7,164	9,935	5,262
df	4	4	4	4	4	4	4	4	4
Asymp. Sig.	,074	,012	,522	,183	,745	,292	,127	,042	,261
	Grouping Variable: Marital status								
Chi-Square	4,991	2,000	4,705	6,998	10,210	6,834	,378	5,093	2,693
df	4	4	4	4	4	4	4	4	4
Asymp. Sig.	,288	,736	,319	,136	,037	,145	,984	,278	,610
Grouping Variable: Number of children									
Chi-Square	14,220	3,114	3,926	2,309	,591	3,546	5,918	3,314	7,257
df	4	4	4	4	4	4	4	4	4
Asymp. Sig.	,007	,539	,416	,679	,964	,471	,205	,507	,123
Grouping Variable: Education									
Chi-Square	,616	2,557	2,420	4,099	3,121	5,885	5,751	2,795	12,629
df	4	4	4	4	4	4	4	4	4
Asymp. Sig.	,961	,634	,659	,393	,538	,208	,219	,593	,013
Grouping Variable: Work status									
Chi-Square	4,385	6,732	5,065	2,079	1,012	7,997	2,449	8,529	3,981
df	5	5	5	5	5	5	5	5	5
Asymp. Sig.	,495	,241	,408	,838	,962	,156	,784	,129	,552

Factors of state-supported countryside walking tourism on the interest of tourists	I-1	I-2	I-3	I-4	I-5	I-6	I-7	I-8	I-9
Grouping Variable: Annual personal investment for tourist travel and vacation									
Chi-Square	2,899	,752	,106	,815	4,927	,262	3,182	2,620	2,622
df	2	2	2	2	2	2	2	2	2
Asymp. Sig.	,235	,687	,948	,665	,085	,877	,204	,270	,269

Source: Authors' calculations

Using the Kruskal-Wallis H Test, there were statistically significant differences regarding the following factors:

- I-2 between the *age groups* (≤25, n=82, 26-35 n=54, 36-45 n=119, 46-55 n=128, ≥56 n=84), c^2 (2, n=467)=12,779, p=0,012, Md=0; regarding the mean values of group ranks, I-2 was at the highest level in the *26-35 age group*, and at the lowest level in the *≥56 age group*;
- I-8 between the *age groups* (≤25, n=82, 26-35 n=54, 36-45 n=119, 46-55 n=128, ≥56 n=84), c^2 (2, n=467)=9,935, p=0,042, for the *26-35 age group* Md=1, for other groups Md=0; regarding the mean values of group ranks, I-8 was at the highest level in the *26-35 age group*, and at the lowest level in the *≤25 age group*;
- I-5 between the *marital status groups* (single, n=125; cohabitation, n=61; married, n=238; divorced, n=29; widow/widower, n=14), c^2 (2, n=467)=10,210, p=0,037, for the *divorced group* Md=1, for other groups Md=0; regarding the mean values of group ranks, I-5 was at the highest level in the *divorced group*, and at the lowest level in the *widow/widower group*;
- I-1 between the *number of children groups* (0, n=182; 1, n=100; 2, n=142; 3, n=41; ≥4, n=2), c^2 (2, n=467)=14,220, p=0,007; *0, 1 and ≥4 number of children groups* had the equal median (Md=1), *2 and 3 number of children groups* had the equal median (Md=0); regarding the mean values of group ranks, I-1 was at the highest level in the *≥4 number of children group*, and at the lowest level in the *2 number of children group*;
- I-9 between the *education groups* (without formal education, n=2; primary education, n=3; secondary education, n=92; college, n=60; university, n=310), c^2 (2, n=467)=12,629, p=0,013; *without formal education and secondary education groups* had the equal median (Md=0), *primary education, college, and university groups* had the equal median (Md=1); regarding the mean values of group ranks, I-9 was at the highest level in the primary education group, and at the lowest level in the without formal education group.

There were no statistically significant differences regarding the following factors: I-3, I-4, I-6, and I-7. Statistically significant differences were observed for factors I-1, I-2, I-5, I-8,

and I-9 for all grouping variables except for the *work status group* and *annual personal investment for tourist travel and vacation groups*. Hypothesis H3 was not confirmed.

Conclusions

The countryside walking tourism foreseen by the policy of sustainable rural and tourism development of the country would primarily contribute to the interest of tourists due to safety, content, price, better meeting the needs of urban residents for outdoor activities, as well as environmental protection. In addition, for females, the state-supported countryside walking tourism would influence the interests of tourists because of the authentic gastronomy, traditional products, the inclusion of the local population, and the well-being of urban residents. Females have a greater need for the development of countryside walking tourism. In general, tourists prefer to choose an authentic local house and cuisine, as well as a local tour guide, and look at a village as the epicenter of countryside walking tourism.

The global recognition of the destination and the organization of family trips and children's stays in the countryside and nature are highly important among the age group from 26 to 35 years. The possibility of consuming authentic gastronomy, wine, souvenirs, textile items footwear, etc. is more significant for those who are divorced, while the safer stay, better content, and more affordable prices are the favorite interest of people with four and more children. For people with primary education, the need of urban residents for a light pace of life, outdoor physical activity, and leisure contributes to the development of rural tourism, which is the most important aspect of countryside walking tourism in the country's sustainable development strategy that strongly influences the interest of potential tourists.

Given that the validity of the sample was not examined, the authors point out that the results of this research should not be generalized but used for further research. This research is the beginning of gaining in-depth knowledge on this issue and it will be continued by researching the impact of people's interest in healthy and active life on the development of countryside walking tourism, by developing a cluster-based concept of management, funding, promotion, and internationalization of countryside walking tourism. Embedding countryside walking tourism in sustainable rural tourism development policies is recommended. The research contributes to the integration of sustainable rural development and sustainable tourism development.

Acknowledgments

This paper was supported by Singidunum University, Belgrade.

Conflict of interests

The authors declare no conflict of interest.

References

1. Ayazlar, G., & Ayazlar, R. A. (2015). Rural Tourism: A Conceptual Approach. In *Tourism, Environment and Sustainability* (pp. 167-184).
2. Balaskas, A., Lima, E., & Seed, T. (2009). A strategic approach to sustainable development through official development assistance. *Master thesis*. Retrieved April 27, 2022, from http://bth.diva-portal.org/smash/get/diva2:830423/FULLTEXT01.pdf
3. Bešić, C., Mihalj, B., Đorđević, D., & Ćoćkalo, D. (2021). Agriculture 4.0 and improving competitiveness of the domestic agro-food sector. *Economics of Agriculture*, 531-545. doi:10.5937/ekoPolj2102531B
4. Borović, S., Stojanović, K., & Cvijanović, D. (2022). The future of rural tourism in the Republic of Serbia. *Economics of Agriculture, LXIX*(3), 925-938. doi:10.5937/ekoPolj2203925B
5. Čavić, D., Radojković, M., & Vujanović, M. (2020). Innovative food products as a basis for the development of rural tourism in Vojvodina. *Economics of Agriculture, LXVII*(4), 1283-1295. doi:10.5937/ekoPolj2004283C
6. Cohen, J. W. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, Nj: Lawrence Erlbaum Associates.
7. Cvijanović, D. (2009). System of education, scientific research and consulting work in agriculture of Serbia. *113. Seminar of the EAAE* (pp. 61-72). Belgrade: Institute of Agricultural Economics.
8. Davies, N. J. (2018). Who walks, where and why? Practitioners' observations and perspectives on recreational walkers at UK tourist destinations. *Annals of Leisure Research, 21*(5), 553-574. doi:10.1080/11745398.2016.1250648
9. Euracademy. (2003). Developing sustainable rural tourism. *Thematic guide one*. Retrieved April 27, 2022, from https://www.euracademy.org/wp-content/uploads/2015/06/Thematic-Guide-1.pdf
10. Gram, M. (2005). Family Holidays. A Qualitative Analysis of Family Holiday Experiences. *Scandinavian Journal of Hospitality and Tourism, 5*(1), 2-22. doi:10.1080/15022250510014255
11. Halminen, S. (2019). Apollomatkat Active Holidays: Customer Preferences and Interests. *Bachelor's Thesis*. Retrieved April 14, 2022, from https://www.theseus.fi/bitstream/handle/10024/166200/Thesis_Halminen2019.pdf?sequence=2&isAllowed=y
12. Ivolga, A., & Shakhramanian, I. (2019). Rural tourism as a factor of multifunctional development of rural territories (on materials of Stavropol Region). *WBJAERD, 1*(1), pp. 41-50. doi:10.5937/WBJAE1901041I
13. Kouchner, F., & Lyard, J.-P. (2001). Developing walking holidays in rural areas. *Guide on how to design and implement a walking holiday project*. Retrieved April 25, 2022, from https://enrd.ec.europa.eu/sites/default/files/leaderii_dossiers_tourism_walking-holidays.pdf

14. Kurniasih, P., Nihayah, D. M., Sudibyo, S. A., & Winda, F. N. (2018). Tourism village model based on local indigenous: case study of Nongkosawit tourism village, Gunungpati, Semarang. *ICENIS*, *31*, p. 6. doi:https://doi.org/10.1051/e3sconf/20183109011

15. Landy, F., & Moreau, S. (2015). Right to the village. *Justice spatiale - spatial justice*(7/20151), pp. 1-21.

16. *Law Insider*. (2022). Retrieved April 23, 2022, from Village officials definition: https://www.lawinsider.com/dictionary/village-officials

17. League staff. (2022). *Handbook for General Law Village Officials. Section II Roles and Responsibilities. Chapter 3 Duties of village officials.* Retrieved April 27, 2022, from Michigan Municipal League: https://www.mml.org/resources/publications/ebooks/glv.htm

18. Lin, J.-C., Lin, H.-H., Lu, S.-Y. L., Chien, J.-H., & Shen, C.-C. (2022). Research on the current situation of rural tourism in southern Fujian in China after the covid-19 epidemic. *Open Geosciences, 14*(1), 24-43. doi:https://doi.org/10.1515/geo-2020-0335

19. Mitić, V., & Čolović, M. (2022). The main demographic characteristics of customers and the frequency of purchases organic food. *Economics of Agriculture, LXIX*(2), 349-364. doi:10.5937/ekoPolj2202349M

20. Molgo & Etfi. (2021). *The European market potential for walking tourism*. Retrieved May 2, 2022, from CBI Ministry of Foreign Affairs: https://www.cbi.eu/market-information/tourism/walking-tourism/market-potential

21. Nedeljković, M., Puška, A., & Krstić, S. (2022). Multicriteria approach to rural tourism development in Republic of Serbia. *Economics of Agriculture, LXIX*(1), 13-26. doi:10.5937/ekoPolj2201013N

22. Polukhina, A., Sheresheva, M., Efremova, M., Suranova, O., Agalakova, O., & Antonov-Ovseenko, A. (2021). The Concept of Sustainable Rural Tourism Development in the Face of COVID-19 Crisis: Evidence from Russia. *Journal of Risk and Financial Management, 14*(1), 1-19. doi:10.3390/jrfm14010038

23. Popesku, J. (2016). *Menadžment turističke destinacije* (Vol. V). Beograd: Univerzitet Singidunum. [*in English*: Popesku, J. (2016). *Tourist destination management* (Vol. V). Singidunum University, Belgrade].

24. Quinn, B., & Stacey, J. (2010). The Benefits of Holidaying for Children Experiencing Social Exclusion: Recent Irish Evidence. *Leisure studies, 29*(1), 29-52. doi:10.1080/02614360903046631

25. Silva, L. (2022). The impact of the covid-19 pandemic on rural tourism: a case study from Portugal. *Anatolia. An International Journal of Tourism and Hospitality Research, 33*(1), 157-159. doi:10.1080/13032917.2021.1875015

26. Simeoni, F., & De Crescenzo, V. (2019). Walking tourism: opportunities and threats for sustainable development. The case of the 'VA' SENTIERO' project. *XXII International conference excellence in services*, (pp. 541-554). Thessaloniki.

27. Šimkova, E. (2007). Strategic approaches to rural tourism and sustainable development of rural areas. *Agricultural economics, 53*(6), 263-270. doi:https://doi.org/10.17221/979-AGRICECON

28. Štetić, S., & Šimičević, D. (2017). *Menadžment turističke destinacije.* Beograd, Srbija: Visoka turistička škola strukovnih studija Beograd. [*in English*: Štetić, S., & Šimičević, D. (2017). *Tourist destination management.* High School of Tourism Vocational Studies Belgrade, Belgrade].

29. Tomaš Simin, M., Rodić, V., & Glavaš-Trbić, D. (2019). Organic agriculture as an indicator of sustainable agricultural development: Serbia in focus. *Economics of Agriculture, LXVI*(1), 265-280. doi:10.5937/ekoPolj1901265T

30. United Nations Development Programme. (2022). *Sustainable Development Goals*. Retrieved April 23, 2022, from UNDP: www.undp.org

31. Vujović, S., Cvijanović, D., & Štetić, S. (2012). *Destinacijski koncept razvoja turizma.* Beograd, Srbija: Institut za ekonomsku poljoprivredu Beograd. [*in English*: Vujović, S., Cvijanović, D., & Štetić, S. (2012). *Destination concept of tourism development: monograph.* Institute for Economic Agriculture Belgrade, Belgrade]

32. WTO & UNDP. (2017). *Tourism and the Sustainable Development Goals – Journey to 2030.* Retrieved April 23, 2022, from eLibrary: http://www.e-unwto.org/doi/book/10.18111/9789284419401

PERCEPTIONS OF WINE HEALTH BENEFITS AND EFFECTS OF WINE CONSUMPTION ON WELL-BEING

Anita Silvana Ilak Peršurić[1], Sara Rossi[2], Ena Bestulić[3], Sanja Radeka [4]

**Corresponding author E-mail: anita@iptpo.hr*

ARTICLE INFO

Original Article

Received: *11 October 2022*

Accepted: *10 January 2023*

doi:10.59267/ekoPolj2301145S

UDC 663.2:159.938.363.6

Keywords:

moderate wine consumption, wine consumers' survey, health, well-being, Croatia

***JEL**: D01, D12, D 91, I19,I39, Q19*

ABSTRACT

he purpose of the survey was to identify and analyze moderate wine consumption of Croatian autochthonous wine varieties. The survey was conducted in 2019 and 2020 on the Croatian Science Foundation scientific project "Vinum Sanum". Dimensions of wine and health benefits, wine quality, labelling, positive and negative effects on wine labels and psychological well-being were assessed with a questionnaire from 374 participants. Results indicated that wine was perceived as a healthy beverage, consumed as part of healthy life style. Health benefits were perceived positively through cardiac, physical health and psychological well-being. Most important quality features were: origin; micro region, terroir, PGI/PDO (protected geographic origin/protected designation of origin), vintage, ageing and sugar content. This survey might be used as scientific evidence for developing health claims for wine, for producers to use health enhancing properties of wines and create packages and/or labels which may boost the positive perception of wine health benefits.

Introduction

The spreading awareness of the impact of the human diet on health, physical and psychological condition translates often to consumers' food and beverages choices. The expectations upon food and beverages in human diets result in consumers' interest about items that may have positive health effects and could prevent nutrition-related diseases.

1 Ilak Peršurić Anita Silvana, Scientific advisor with permanent election, Institute of Agriculture and Tourism, K. Hugues 8, 52440 Poreč, Croatia, Phone: +385 52 408 329, E-mail: anita@iptpo.hr, ORCID ID (https://orcid.org/0000-0001-5234-7602)

2 Sara Rossi, Assistant, Institute of Agriculture and Tourism, K. Hugues 8, 52440 Poreč, Croatia, +385 52 408 341, E-mail: sarar@iptpo.hr, ORCID ID (https://orcid.org/0000-0003-2691-0662)

3 Ena Bestulić, Assistant, Institute of Agriculture and Tourism, K. Hugues 8, 52440 Poreč, Croatia, Phone: +385 52 408 341, E-mail: ena@iptpo.hr, ORCID ID (https://orcid.org/0000-0001-9203-3958)

4 Sanja Radeka, Scientific advisor, Institute of Agriculture and Tourism, K. Hugues 8, 52440 Poreč, Croatia, Phone: +385 52 408 339, ORCID ID (https://orcid.org/0000-0002-3869-1412)

The health awareness and expectations of consumers' apply also to the impacts of wine as a dietary item that may also create positive health effects. Consequently wine became a topic of scientific interest ever since the discovery of the so-called 'French paradox' (a diet of high fat and cholesterol intake along with red wine that does not negatively impact health factors, such as cardiovascular risks) by Renaud and de Lorgeril (1992). Based on their empirical findings, similar studies were created for surveys of food items, e.g. olive oil, organic food (Roinen et al., 1999; Maechle et al., 2015; Ilak Peršurić, 2020; Rizzo et al., 2020).

Developing the established theories of food and health, the survey of Kaur & Paul Singh (2017) used the existing literature, reviewing the determinants of human behaviour towards functional foods. The most important factors were described as; personal factors (age, gender, education, income, marital status, health status, awareness/ familiarity, willingness to use functional foods, pleasure in eating); psychological factors (beliefs, motivations, perceived quality, benefits, risks, pleasantness); cultural and social factors (cultural and social norms, role of family, friends, presence of children at home, geographic location, ethnic origin, social status) and factors related to the product (ingredients/function, convenience, price, taste and other sensory measures, naturalness, health-full, brand, labelling, regulations, domestic production, innovativeness). These factors and their variables were also detected in studies that have concentrated on consumer perceptions of wine as a healthy product (Bariero-Hurlé et al., 2008; Samoggia 2016; Vechio et al., 2017;).

Health aspects and wine

Consumers' are aware about the effects that consumed food and beverages have on their health. In consumers' studies food and beverages were associated in a context of well-being (Ares et al., 2015; Diener et al., 1999, 2003; Guilemin et al., 2016) since the consumers estimated their personal well-being or behavior in relation to food and wine choices (Corduas et al., 2013; Higgins & Llanos, 2015). Some authors discussed the consumers' traditional food perception (Guirrero et al., 2010) associated to celebrations, seasons and traditional aspects and wine as a tradition, especially in the Mediterranean diet (Willcox et al., 2014). A literature review showed both positive and negative perceptions of wine (Guilford & Pezzuto, 2011) referring positively to cardiovascular health (Goldberg et al., 2001), gastrointestinal and neurological aspects (Reale et al., 2020), diabetes and immune parameters (Magrone et al., 2008). A consumers' study of Vecchio et al. (2017) showed that wine consumers believe that moderate wine consumption has positive effects on their health and believed it was beneficial in preventing diseases. Further, wine consumers were also interested in wines that contained more antioxidants. According to Barriero-Hurlé et al. (2008) wines with higher levels of bioactive substances, such as phenols, moreover stilbenes and especially resveratrol (being one of the main stilbenes found in wine) may be marketed as "functional wines" in the future. Wine consumers believed that production technology improves food quality, that food quality controls are reliable, information from producers trustworthy and that in the future a functional wine product can be produced.

The awareness about the positive effects of resveratrol and other wine compounds on cardiovascular health and Alzheimer's disease were showed in medical surveys (Anekonda, 2006; Shen et al. 2015; Reale et al., 2020). Further, Magrone et al. (2008) showed the positive effects of wine on the immune system, while Flechtuer-Mors et al. (2004) demonstrated its effects on overweight persons. A suggestion upon moderate alcohol consumption (1 to 2 drinks a day – equals up to 60 mL of alcohol) responds to intake of wine since it is more beneficial than other alcoholic beverages. The findings of Goldberg et al. (2001) provided overall medical evidence about benefits of antioxidants present in wine (decreasing platelet aggregation, through prostaglandin and fibrinogen inhibition, tested "in vitro" on animals). Authors suggested that light to moderate consumption of any type of alcohol provides antithrombotic benefits similar to aspirin use. Adverse effects were associated with the intake of more than three servings of alcohol daily (fetal alcohol syndrome, cardiomyopathy, hypertension, hemorrhagic stroke, cardiac arrhythmia, sudden death).

Moderate wine consumption provides pharmacological, biological, and physiological benefits for human health, including blood pressure, cholesterol and lipids regulation, prevention of diabetes, obesity, atherosclerosis and cardiovascular diseases, as well as anti-inflammatory, antioxidant and antitumor effects (Khalil & Tazeddinova, 2020; Vaquero et al., 2007). In addition to the positive impact on physical health, the positive effect on mental health is also evident in protecting neuronal cells from damage, preventing neurodegenerative diseases, facilitating the treatment of depression, improving cognitive function, and increasing memory (Qi, et al., 2015). In comparison with other alcohols, healthy properties in wines are resulting with added value, which is largely associated with the presence of polyphenols, mainly resveratrol (Gutiérrez-Escobar et al., 2021). Additionally, some authors reported that moderate wine consumption may ensure peoples longer life expectancy, comparing to consuming wine in excess or not consuming wine at all (Ruf, 2003; Plunk et al., 2014; Gutiérrez-Escobar et al., 2021).

Within the frame of the moderate consumption wine may be perceived as a "healthy" food but also as "permissive" food in a hedonistic way (Fiore et al 2019; Higgins & Llanos 2015). From the general surveys on food and beverages, cross the surveys of positive health effects, in this paper we refer to the similarities of the recent findings and relate them to our survey about wine and the effect of moderate wine consumption.

Labelling health warnings on wine

Although wine has been surveyed as a heathy beverage as explained in the previous chapter of this paper, wine was also surveyed through possible negative effects on human health. Some authors expressed concerns about legislations which could hinder unintentional harmful effects of wine (Annunziata et al 2016; Jovanović & Atanasovska Cvetković, 2022). Warning labels inform consumers of risks associated with alcohol consumption and may reduce dangerous drinking behavior (Eurocare, 2013). In this way the awareness of negative impacts of wine may rise and wine as an item may be

recognized in human diets as a beverage which may also create negative health effects. Currently in Croatia there are no regulations related to labelling either positive or negative effects of wine on human health. The information on the Croatian wine labels show the production area and designation of origin, grape variety, vintage, awards showing. Therefore the goal of our survey was to detect future interest of consumers that may relate to information that is not currently present on wine bottles, particularly, nutritional information, number of glasses not to exceed due to health concerns, age and health limited consumption.

Explanations about negative effects of wine currently exist in some European countries (Eurocare, 2013, 2014), for example, some have statements (Germany) while others have pictures (Italy) describing that alcohol is not suitable for persons under age 18 and pregnant women. Findings in Italy showed that the necessity of labelling was connected to the socio demographic features of wine consumers, pointing that women and younger persons were more interested in wine label indications of positive and negative effects of wine (Annunziata et al., 2016).

Wine quality

Wine quality may be perceived from the technical or productive point; objective product characteristics, consumer preferences, intrinsic (expected quality) and extrinsic attributes (experienced quality) (Verdu Jover et al., 2003). Quality measurements were also studied through dimensions of quality: hedonic (good, full rich taste), health (natural product, lower/higher cancer risk, positive/negative effects on gut/immune system), process (traditional, not GMO, good for environment) and convenience (price, save money) (Grunnert et al., 2000; Ilak Peršurić & Mann, 2019; Maehle et al., 2015).

The wine label contains diverse information on the bottle that informs consumers about the origin (land of production, terroir, geographical protection, producer), grape variety, harvest year, alcohol, sugar and sulphur content, that are prescribed by laws and regulations of each European country (Eurocare, 2013, 2014). Wine consumers evaluate information on wine labels as extrinsic attributes which assist them in wine choice, prior to purchase and consumption (Bernabeu et al., 2012). After wine consumption intrinsic attributes such as aroma, bouquet, colour, taste may be evaluated (Corduas et al., 2013). Further, consumers relate wine to their lifestyle adopting certain habits in consumption, preferences for certain wines, wine types or consumption frequency (Hristov and Kuhar, 2015; Corduas et al., 2013; Verdu Jover et al., 2003). Wine consumers may connect wine to moments, everyday enjoyment or social occasions, e.g. festivities, birthdays, new Year's (Yang and Li 2019).

Materials and methods

Data collection was performed with a sample of Croatian wine consumers during 2019 and 2020 on the Croatian Science Foundation scientific project "Vinum Sanum" "Influence of different vinification technologies on the qualitative characteristics of wines from Croatian autochthonous varieties: the role of wine in human diet".

Participants were invited by a public call, via the website of the Institute of agriculture and tourism in Poreč, and by personal contacts of the authors using the snowball effect. After the initial written agreement to participate in the survey, the participants gave their written informed consent for participation on the project and in the survey. Through this process of application more female than men participants applied. In total 25 different groups were formed. Consumers consumed wines in a moderate way 2 dl daily during a six week trial, according to the propositions of healthy moderate wine consumption (adopted from literature; Flechtuer-Mors et al., 2004., and Golderg et al., 2001, and Eurocare 2013,2014). The wines consumed were produced of Croatian autochthonous white and red grapevine varieties: Malvazija istarska, Pošip, Plavac mali, Teran (see appendix). The wines were obtained from the experimental production at the Institute of agriculture and tourism in Poreč; the Malvazija istarska wines were produced in vinification treatments: (MC) control treatment without maceration, (TAN) treatment without maceration with the addition of tannin, (M1) pre-fermentatitive cold 1-day maceration, (M7) 7 days maceration, (M21) 21 day maceration and (LH) late harvest grape vinification. Three of these wines were aged in barrique barrels and named M7B, M21B, LHB. The Teran wines were produced in vinification treatments: TPHT 48h prefermenative heating at 45 degrees, followed by 8 day clasical maceration, (TM7) control treatment with 7 days of maceration, (TM10) prolonged 10 day maceration, (TM21) prolonged post-fermentative 21 day maceration. These wines were aged in barrique barrels and named TPHTB, TM7B, TM10B, TM21B. The wines bought from the open market were from different parts of Coastal Croatian regions: Hrvatska Istra subregion MF (Malvazija fresh), MA (Malvazija aged), TF (Teran fresh), TA (Teran aged), and Central and Southern Dalmatia sub region PF (Pošip fresh), PA (Pošip aged), PMF (Plavac fresh), PMA (Plavac aged).

The survey with the questionnaire was performed at the Institute of agriculture and tourism in Poreč and at the Faculty of Humanities and Social Sciences in Rijeka. The questionnaire was administered to adult wine consumers (over age 18) and the informed consent was obtained from all participants involved in the study. The study was carried out in accordance with the Declaration of Helsinki developed by the World Medical Association and was approved by the Ethics Committee of the Clinical Hospital Center Rijeka (Croatia). No incentive was given to participants. In total 374 questionnaires were obtained. The questionnaire about wine was designed to examine four aspects of moderate wine consumption; wine and health benefits, wine quality, labelling positive and negative effects on wine labels.

The methodology was adopted from the survey of Kaur et al. (2017) and Guilemin et al. (2016) based on the determinants of human behavior towards functional foods. The methodology of measuring consumers' perceptions of wines quality was adopted from Verdu Jover et al. (2003) while the measurement of wine consuming frequency was adopted from Yabin & Li (2019). The wine quality dimensions were evaluated by extrinsic and intrinsic attributes which were included in the same scale (similar to Verdu Jover et al., 2003) whereas extrinsic attributes were: reputation, region, appellation d'Origine, advertising and propaganda, distribution channels, bottling and labelling, brand, price, while intrinsic

were: age, harvest, alcohol content, varieties, taste, aroma, colour. From the measurement of attitudes toward healthy food (Roinen & Tourila, 1999), measures of health related and taste factors were used (general health, natural products, food as reward, pleasure).

Our starting hypothesis was that some changes of participants' opinions were expected at the beginning and at the end of the moderate wine consumption. The obtained two sets of data (before and after the consumption period) were compared to single out those items that showed significant differences between observed groups after the consumption period. Additionally due to the fact that we had 25 different groups we set a second hypothesis; different wines consumed may affect different opinions and attitudes of participants, also in terms of two time points of measurement. Therefore the data processing was performed in order to observe differences in the changes of consumers' attitudes for each item between the first and the second measurement. In data processing we have used descriptive analysis, correlation between variables and analysis of variance (One-way analysis of variance (ANOVA) and correlation analysis was performed to examine the differences between specific consumer groups. The average values of each item were compared using Fisher's Least Significant Difference (LSD) test at the level of $p<0.05$. using Statistica v.13.2 software (Stat-Soft Inc., Tulsa, OK, USA). The measurement scale used in the survey was a Likert type scale which ranged from one (totally disagree) to five (totally agree) which measured wine consumers attitudes toward wine items (the scale was defined as an evaluation of a particular entity with some degree of favor or disfavor, adopted from Ilak Peršurić & Mann, 2019). Measurements of some psychological aspects used the General Well-Being Schedule with a self-assessment measure, aimed at examining subjective feelings of general well-being, psychological well-being, and distress (adopted from Dupuy 1978 and Diener et al., 1999). The measurement scale of subjective well-being was measured with a Likert type scale which ranged from one to five, for general feeling (one excellent, to five very low), nervousness (1 extremely much so I could not work, to five not at all), stress, pressure (one unbearable, to five not at all), being happy, satisfactory, full of life (one extremely happy, to five very unhappy), being anxious, worried, upset (one extremely anxious, to five not at all).

In order to test the hypothesis if all participants shared some similar opinions and attitudes, regardless the two referent time points (before/after) about wine and health benefits, wine quality, labelling, positive and negative effects of wine and psychological well-being a factor analysis was carried out through exploratory factor analysis (EFA). The factor dimensions were calculated by using Cronbach alfa coefficients which have reduced the number of items and dense the factors in the factor matrix. The maximum likelihood extraction method was used. From 18 wine quality items 7 remained (micro region, terroir, producer, recommendations of friend, sales person, waiter, own knowledge, label and package attractiveness, awards, quality label – PGI, PDO (protected geographic origin/protected designation of origin), wine complexity, taste, color and smell of wine, sugar content, ageing, harvest/vintage, price, price discounts). All positive health benefits entered in the factors matrix, counting 9 items (heart health, blood vessels health, cholesterol levels in blood, psychological health and memory, blood sugar levels, neuro vegetative diseases, body weight, physical condition (energy),

metabolism). From six psychological items (happy, good feeling, emotional stability, feeling nervous, under pressure/stress, anxious) four entered the factor matrix. The risks of wine consumption had 5 items from which 2 remained (do not drink and drive, do not consume with medicine, not for persons under age 18, not for pregnant women, consume in a moderate way).

Since currently in Croatia there are no regulations that relate to labelling either positive or negative effects of wine on human health (NN32/19) we wanted to test how wine consumers respond to the possibility of applying statements or pictures of health warnings about possible negative effects of wine. The idea was drawn from recent European documents and surveys which tackle labelling of alcohol and presence of ingredients and allergens on the labels (Eurocare 2013). Positive statements on the wine label were questioned: consumers' interest, such as nutritive, anti-oxidative effects, benefits for general, heart, blood vessels health and diminishing cholesterol levels (modified from Goldberg et al. 2001; Eurocare 2013). Statements about driving and drinking, taking alcohol with medicines, avoiding drinking during pregnancy and banning alcohol for children of age below 18 were used (modified from Annunziata et al. 2016).

The aim of this survey was to verify how wine consumers respond to wine attributes, to either positive or negative health benefits (regarding effects of wine on human health), and to the possibility of applying statements or pictures of health warnings on wine labels (since no such surveys exist in Croatia and no regulations exist currently regulating this information).

Results

The sample consisted of the respondents whose sociodemographic features are shown in Table 1. and were in majority female (62.1%), and in minority males (37.9%). The sociodemographic structure was a consequence of the chosen methodology and the free will application of participants. Most respondents had between 26 and 54 years of age (73%). According to their employment status the majority were employees (58.8%), and the minority were entrepreneurs/self-employed, managers, unemployed/retired, students/pupils. They have obtained in ¾ of cases higher education level (75.7%), while ¼ of participants had secondary education or less (24.3%).

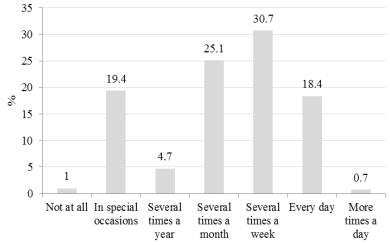
Table 1. Sociodemographic features of the survey respondents (N = 374)

Gender	Age (years)	Education	Occupation	Monthly personal income
Female (62.1%)	20-29 (18.9%)	Elementary (0.6%)	Entrepreneur/ Self-employed (14.0%)	≤ 333 € (4.2%)
Male (37.9%)	30-40 (24.1%)	Secondary (23.7%)	Manager (10.6%)	334–533 € (11.0%)
	41-50 (17.1%)	University (75.7%)	Employee (58.8%)	534-933 € (39.9%)
	50-60 (26.7%)		Retired (3.9%)	≥ 1001 € (14.2%)
	≥61 (13.2%)		Pupil/student (8.4%)	
			Unemployed (4.3%)	

Source: Authors survey

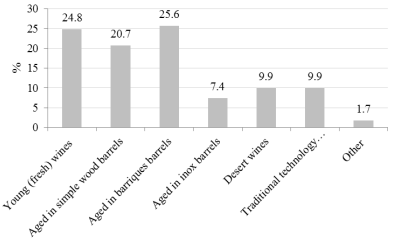
According to their usual habits of wine consumption (Figures 1-4), half of the respondents were consuming daily 2 dL of wine, one third was consuming 1 dL daily, while less than 10% consumed 3 and more dL wine daily. Half of the respondents preferred dry wines, each fifth preferred semidry, each tenth preferred semisweet and sweet wines, while less than 10% preferred sparkling and special, liquor wines. Considering the frequency of wine consumption, one third consumed it several times a week, a quarter several times a month, and about equal share of them consumed wine daily, several times a year or in special occasions.

Figure 1. Wine consumption frequency



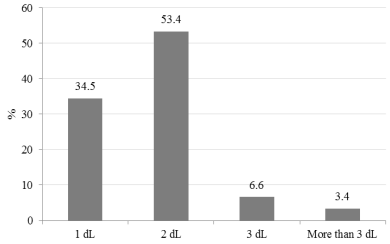
Source: Authors survey

Figure 2. Preferences to wine types



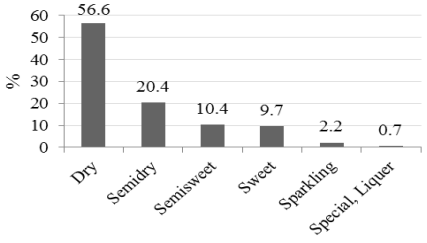
Source: Authors survey

Figure 3. Daily wine consumption



Source: Authors survey

Figure 4. Preference to wine sugar content



Source: Authors survey

Survey participants were asked about the degrees of importance of several health aspects of wine, quality aspects of wine (Table 2.). Participants estimated that wine was as a healthy beverage and its anti-oxidative compounds as very important and important in three quarters of cases.

Quality aspects of wines, such as sugar, were very important/important to 90%; quality (PGI/PDO, protected geographic origin/protected designation of origin) and vintage to 60%. The positive effects were estimated by health effects through general positive effects on human health, heart and blood vessels health and rise of mood by approximately 65% of participants. Positive effects on psychological health and memory were very important/important to roughly half of the participants. Wine was perceived also important as a remedy for a rest after work obligations, very important/ important to a half of participants.

Table 2. Importance of wine and health items

Importance (in %) N = 374	Not at all	Low	Neither important or unimportant	Important	Very important
Heart health	(3.0%)	(8.3%)	(31.0%)	(32.1%)	(25.5%)
Blood vessels health	(2.2%)	(8.0%)	(26.0%)	(38.5%)	(25.2%)
Cholesterol levels in blood	(6.1%)	(15.0%)	(32.4%)	(30.5%)	(16.1%)
Psychological health and memory	(7.2%)	(11.1%)	(36.0%)	(28.8%)	(16.9%)
Blood sugar levels	(9.7%)	(13.9%)	(36.4%)	(26.1%)	(13.9%)
Neurological diseases	(10.0%)	(11.6)	(39.3%)	(22.4%)	(16.6%)
Body weight	(5.5%)	(17.5%)	(35.5%)	(21.6%)	(10.0%)
Physical condition (energy)	(15.5%)	(13.0%)	(38.8%)	(20.2%)	(12.5%)
Metabolism	(8.3%)	(14.1%)	(36.6%)	(27.1%)	(13.9%)
I consume wine as part of healthy lifestyle	(5.9%)	(18.5%)	(33.6%)	(28.6%)	(13.4%)
Positive general effect on human health	(2.8%)	(7.5%)	(23.6%)	(40.3%)	(25.8%)
Wine is a natural beverage	(2.8%)	(2.8%)	(18.6%)	(40.0%)	(35.8%)
Rest after work	(7.8%)	(12.2%)	(27.1%)	(33.2%)	(19.7%)
Rise of mood	(3.3%)	(8.8%)	(24.3%)	(39.5%)	(24.0%)
Wine complexity - bouquet	(1.4%)	(3.6%)	(18.1%)	(37.0%)	(39.8%)
Anti-oxidative compound	(4.5%)	(7.3%)	(22.1%)	(28.8%)	(37.4%)
Micro region - vineyard	(7.5%)	(10.3%)	(35.8%)	(29.6%)	(16.8%)
Terroir	(7.9%)	(10.7%)	(37.4%)	(30.9%)	(13.2%)
Ageing	(4.2%)	(9.5%)	(29.9%)	(37.4%)	(19.0%)
Harvest/vintage	(5.3%)	(10.9%)	(25.1%)	(40.5%)	(18.2%)
Sugar content	(0.0%)	(3.8%)	(4.6%)	(21.4%)	(70.2%)
Quality (PGI/PDO)	(5.0%)	(8.4%)	(26.0%)	(42.5%)	(18.2%)
Consumption with medicine	(5.0%)	(6.4%)	(9.2%)	(19.5%)	(59.9%)
Pregnancy	(6.4%)	(7.8%)	(18.1%)	(18.6%)	(49.2%)
Drinking and driving	(2.8%)	(4.2%)	(8.1%)	(14.7%)	(70.3%)
Perception (in %) N = 374	**Not at all**	**A little**	**Pretty much**	**Very much**	**Extremely**
Good-happy personal feeling	(6.4%)	(5.0%)	(44.0%)	(16.9%)	(5.1%)
Feeling nervous	(70.2%)	(21.4%)	(4.6%)	(3.8%)	(0.0%)
Feeling anxious	(81.2%)	(10.2%)	(7.5%)	(0.8%)	(0.3%)
Feeling under pressure/ stress	(6.4%)	(20.6%)	(23.9%)	(44.0%)	(5.1%)

Source: Authors survey

The items in Table 2., were compared with ANOVA at the beginning of the 6 week trial and at the end for consumers groups who consumed experimental Malvazija istarska and Teran wines and groups who consumed Malvazija istarska, Teran, Pošip and Plavac mali market wines (codes are listed in methodology). Data processing with ANOVA showed no statistical significant changes for all Malvazija istarska experimental

groups. The starting hypothesis about the possible differences at the beginning and end of the trial was not supported for the participants of Malvazija istarska experimental groups. Therefore we proceeded with ANOVA to estimate if the differences (end minus beginning grades) would show any significance for Teran. In the case of experimental Teran wines, two items showed statistically significant differences among groups: blood vessels health and micro region, and we observed both the increase and a decrease of the consumers' attitudes towards those items. For both items, in TM7, TM21, TM10B and TPHTB groups the attitudes increased, while in other consumers groups the attitudes decreased after consumption. However, the only significant difference was observed between TM7 and TPHT for blood vessel health, and in the case of micro region, between TM7, TM21, TM10B and TM21. Our starting hypothesis about the possible differences at the beginning and end of the trial was partly supported for the participants of Teran experimental groups.

For open market wines considerable more statistically significant differences occurred for wine items: natural beverage, general positive benefits, rise of mood, psychical condition (energy), pregnancy, and quality (PGI/PDO), regarding consumer's attitudes. In the case of general positive benefits item, consumer's attitudes increased after the consumption period in almost all consuming groups (MF,MA,TF,PF,PA,PMF,PMA). Similar results were obtained with the rise of mood item that showed an increase in several consuming groups (MA,TF,PA,PMF,PMA), while other groups showed a decrease in consumers' attitudes for the mood rise. For psychical condition (energy) few groups attitudes increased, MF, TF, PF, PA, PMA. For item pregnancy almost all groups increased except MA, TA. Regarding quality (PGI/PDO) item, consumers attitudes increased in almost every group (MA, TF, PF, PA, PMA, PMF). Therefore the starting hypothesis about the possible differences at the beginning and end of the trial was partly supported for the participants of the market wines experimental groups.

From the participants point of view the most important feelings that affected them during the six week trial of moderate wine consumption were both positive and negative feelings. The negative feelings were feeling anxious, feeling nervous, and feeling under pressure, while the positive feeling was feeling happy, a sense of personal good feeling. We assumed that there some correlation might exist between the positive and negative feelings with health benefits of wines. We also assumed that these correlations might be different and statistically significant among groups of moderate wine consumers, because they consumed different types of wines, therefore we have proceeded the data processing with correlations of wine health benefits and perceptions of negative and positive feelings.

There was no evidence supporting the starting hypothesis about the possible differences at the beginning and end of the trial for all the participants and their feelings. We presume that a six week period is too short to measure effects of wine on either negative or positive human feelings. Considering the negative feelings of anxiety, two consumer groups were more frequent in expressing positive health benefits of wines, namely the group MF and MC. The group MF and MC were more positive to general positive benefits (Cc=0.644, p=0.018; Cc=0.604; p=0.021), positive benefits on

neuro vegetative diseases (Cc=0.702, p=0.001; Cc=0.619; p=0.014), and rise of mood (Cc=0.639, p=0.022; Cc=0.579; p=0.036), while group MF perceived wine benefits also through blood sugar levels (Cc=0.641, p=0.020), while the group MC perceived positive benefits for memory (Cc=0.619, p=0.032).

The correlation of feeling nervous and positive health benefits of wine was most frequent for group M21. The group M21 consumed wine as part of healthy lifestyle (Cc=0.722, p=0.050) and estimated positive health benefits of wine through general positive benefits (Cc=0.729, p=0.048), hart health (Cc=0.753, p=0.020), blood vessels health (Cc=0.755, p=0.019), psychological health and memory (Cc=0.791, p=0.015), cholesterol levels in blood (Cc=0.671, p=0.021), body weight (Cc=0.818, p=0.003) and psychical condition - energy (Cc=0.824, p=0.002). The second most frequently correlated group was group MF for wines providing rest after work (Cc=0.738, p=0.002), providing general positive benefits (Cc=0.762, p=0.000), benefits for neurological diseases (Cc=0.722, p=0.005) and cholesterol levels in blood (Cc=0.671, p=0.021).

The feeling of pressure of every days life, were most elaborated by the group MC that estimated most frequently the positive effects of wine providing rest after work (Cc=0.706, p=0.032), diminishing the feelings of pressure-stress. Groups MF and TPHTB estimated that wine consumption provides a rise of mood, diminishing their stress (Cc=0.696, p=0.016; Cc=0.692; p=0.016). The group M7B estimated most frequently the positive health benefits of wine through positive benefit for hart health (Cc=0.733, p=0.050), blood vessels health (Cc=0.739, p=0.042), psychological health and memory (Cc=0.711, p=0.042), body weight (Cc=0.757, p=0.019) and psychical condition-energy (Cc=0.768, p=0.011). The second most frequently correlated group TAN stated positive effects for hart health (Cc=0.722, p=0.005), neurological diseases (Cc=0.678, p=0.025), cholesterol levels in blood (Cc=0.669, p=0.033).

From the findings of correlations between the negative feelings, such as anxiety, feeling nervous and under pressure-stress and wine, the results had shown that wine provides rest after work, rise of mood and was taken as a remedy to battle the negative effects of everyday life.

Correlations of positive feelings of happiness were more scattered so there was no particular group that stood out in the terms of frequency of statistically significant correlations. Just one group referred that wine is taken to enhance their mood (group TM21, Cc=0.677, p=0.047) and two groups used wine as remedy for rest after work (group MPB and MP, Cc=0.644, p=0.000; Cc=0.729; p=0.048). Health benefits were equally dispersed among all groups so each of them highlighted one health benefit.

Our starting hypothesis about the possible differences among groups was partly supported for the different groups consuming experimental wines. Since there were no consisted relations for all groups of wine consumers for all health benefits of wine, we proceeded with the data processing by comprising all groups and all wine consumers in one group, proceeding to factor analysis to estimate which particular wine items might show their importance for all wine consumers.

We have tried to evaluate our last hypothesis if all participants would share some similar opinions and attitudes, regardless the two referent time points (before/after) and regardless the type of wine consumed. We tested their opinions and attitudes about wine and health benefits, wine quality, labelling, positive and negative effects of wine and psychological well-being.

The exploratory factor analysis which was performed in data processing that measured wine quality, perceived positive and negative benefits of wine, motives of wine consumption, general and actual personal well-being. The final factor matrix model fit indices were acceptable, explaining 69.5% of variance and all items significantly loaded onto their respective latent construct and were higher than 0.40. Correlations were all positive and none of them were excessive.

The final factor matrix included a total of four factors (Table 3), which were named as follows; factor 1 positive health benefits of wine; factor 2 perceived wine quality; factor 3 perceived health risks of wine, factor 4 psychological affects/subjective well-being.

Table 3. Factor analyis of wine health benefits, risks, quality and percieved well-being

Factor	Item	Mean	SD	Standard load
F1 Wine health benefits perception	Heart health	3.6	1.03	0.870
	Blood vessels health	3.7	0.92	0.869
	Cholesterol levels in blood	3.4	1.10	0.822
	Psychological health and memory	3.4	1.10	0.808
	Blood sugar levels	3.2	1.14	0.806
	Neurological diseases	3.2	1.16	0.796
	Body weight	2.9	1.18	0.748
	Physical condition (energy)	3.0	1.20	0.733
	Metabolism	3.2	1.11	0.715
	I consume wine as part of healthy lifestyle	3.5	1.03	0.666
	Positive general effect on human health	3.9	0.92	0.663
	Good-happy personal feeling	3.7	1.01	0.504
	Wine is a natural beverage	4.0	1.06	0.475
	Rest after work	3.4	0.95	0.464
	Rise of mood	3.7	1.16	0.447
	Wine complexity - bouquet	4.1	1.03	0.434
	Wine anti-oxidative compounds	3.9	0.91	0.411
F2 Perceived wine quality	Micro region - vineyard	3.3	1.11	0.736
	Terroir	3.3	1.08	0.727
	Ageing	3.5	1.03	0.633
	Harvest/vintage	3.5	1.07	0.605
	Sugar content	3.3	1.08	0.537
	Quality (PGI/PDO)	3.6	1.03	0.427
F3 Perceived health risks of wine	Consumption with medicine	4.2	1.00	0.608
	Drinking and driving	4.4	0.99	0.565
	Pregnancy	3.9	1.20	0.556

Factor	Item	Mean	SD	Standard load
F4 Psychological well-being perception	Feeling nervous	4.5	0.74	0.552
	Anxious	4.7	0.66	0.496
	Under pressure/stressed	4.1	0.95	0.483
χ^2 = 720.98; dF = 465; p-value = 0.000; αF1=0.92; αF2=0.90, αF3=0.86, αF4= 0.80; KMO= 0.873				

Source: Authors survey

The first factor named "Positive health benefits" showed the most of importance, containing 17 items. The strongest factor loadings (above 0.8) were connected to the positive effects of wine on cardiovascular health (namely, heart, blood vessels health and levels of blood cholesterol) showing that respondents were highly aware of these health benefits. Further strong positive health benefits (above 0.7) were evident for the physical benefits, such as body weight, physical condition (energy) and metabolism. Wine was also perceived as a hedonic remedy providing a rest after work and a rise of mood. The actual psychological state of respondents during the survey showed that wine consumption enhances the current good-happy personal feeling. The utilitarian side of wine consumption was recognized through its positive general effects on human health, wine complexity – bouquet and wine anti-oxidative compounds.

In the factor 2 "Perceived wine quality", respondents showed awareness of wines quality attributes, whereas the micro region-vineyards and terroir were most important (above 0.7). These two quality attributes indicate that respondents were highly aware of the importance that wine is produced at a certain territory and to be distinguished among other wines (from other territories and countries). Ageing of wine and harvest as indicators of quality were also very highly ranked (above 0.6) revealing that respondents recognize the quality of wines changes with ageing (and enhances, especially for red aged wines) and that each harvest provides a different quality differing from year to year (depending on climatic circumstances, time of harvest).

Expressed preferences for dry wines indicated the awareness of this compound and forwarded their preferences toward dry wines (with low content of sugars) establishing healthy choices in wine consumption (less sugar - better for ones' health).

Wine quality was described by geographical indications (PGI/PDO, protected geographic origin/protected designation of origin), ageing/vintage, terroir, micro region/vineyards, which are according to the Croatian wine laws textually indicted on the wine bottle label. These indications were state controlled labels, pointing out the exact wine region where wine is produced and assuring procedures which producers should follow in order to obtain such a label. The factor loading of geographical indications showed that surveyed wine consumers estimated these features of high importance.

Factor 3 explained the possible negative effects of wine, named as "Perceived health risks of wine" and considered the need for the health warnings that will make consumers aware of these negative effects on human health. The respondents showed that the most important risks were related to wine consumption with medicine and driving vehicles

(do not drive and drink) and risks in pregnancy. In the future these statements may be used to recommend new proposals on wine labelling and may be used as an example of the Croatian population.

The last factor, factor 4 "Psychological affects/subjective well-being" described the current state of participants psychological well-being. Their perception of subjective well-being included negative stress affects during the survey, displaying participants expressed affects of being nervous, anxious and under pressure during the last month. These feelings of stress were explained by everyday pressures of work and family obligations. It should be noted that the construct of negative affects was separate from the positive affects expressed in factor 1. Although the participants expressed negative affects, due to external circumstances, they had no negative effects on the perception of positive health benefits of wine and wine quality perception (factor 1 and 2). The stress feelings were at least important in the factor matrix showing that moderate wine consumption diminishes profoundly the stress symptoms.

Discussion

Wine consumption in the case of Croatian participants' has indicated the rationality in taking choices how to consume wine and in which quantities. As a group, they have shown their similar behaviour confirming our main research goal in a positive sense. Their awareness about the importance of moderate wine consumption guided them to consume one or two decilitres a day in about ninety percent of cases. This respond with the suggestions of Goldberg et al. (2001) to the intake of one or two drinks a day with up to 60 mL of alcohol as health beneficial. Croatian participants had high levels of awareness about the "bad" influence of sugar and prevention of diabetes, therefore they most likely choose dry wines for consumption.

The study shown in this paper provides evidence that health benefits of wine were perceived mainly in a positive sense and with positive effects on primarily cardiac health and physical health. Wine consumers believed that wine consumption is beneficial and positive for their health, similar to findings of Vecchio et al. (2017).

The whole group of participants perceived that wine was a healthy product that may enhance a persons' health. The image of wine as a natural product, its smell and taste were highly validated. The familiarity with the healthy compounds of wine (antioxidants) was a prerequisite to the perception of healthy behaviour. Wine was perceived as a healthy indulgence in a way that it provided a rise of mood and after work remedy, within the frames of moderate wine consumption, supporting the results of Fiore et al., 2019. For a minor number of participants wine consumption was connected to social occasions such as festivities or special events indicating that wine may connect to certain life moments, similar to findings of Yang & Li (2019).

Appreciation of wine quality implies that Croats were highly aware of the characteristics of the local wines, emphasizing the micro region and terroir as important or very important. Moreover, the vintage and ageing of wines showed the inclination of

wine consumers to choose particular wines with features particular for a certain year of harvest or a result of ageing in the bottle or wooden barrel. These findings relate to wine quality dimensions expressed by Verdu Jover et al. (2004) and consumption habits findings of Hristov & Kuhar (2015) indicating preferences for certain wines in connection to healthy lifestyles.

Our findings confirm other surveys that point out importance of antioxidants in wine (Guilford & Pezzuto, 2011). Because of the large range of questions asked in the questionnaire and possible misunderstanding about certain antioxidants we did not refer in detail to antioxidants (in the ways Guilford & Pezzuto 2011 described particularly to flavonoids and non-flavonoids in wine such as melatonin, cathechins, ellagic acid, lutein, quercetin as potent antioxidants affecting LDL levels, cholesterol oxidation, platelet aggregation).

Evidence in our study about the awareness of positive effects of wine on body weight supported the thesis of Flechteur & Moss (2004) from a 3 month trial of white wine/ grape juice consumption.

The impact of wine on neurological disorders and cognitive diseases (dementia, stroke, Alzheimer) was also perceived in a positive way, similar to the survey of Anekonda (2006). Wine had not increased the negative feelings of psychological well-being of participants, but on the opposite it was consumed in order to battle the pressures of everyday life. Moderate wine consumption had relaxing effects on some groups and provided rise of mood and rest after work.

Awareness about side effects or possible negative effects of wine consumption were related to driving and to taking medicines, similarly to findings of Annunziata et al. 2016. The participants expressed their concern of taking wine during pregnancy, with medicines and about drinking and driving. Moreover, participants stated that in the future they expect some kind of tags, pictures or written explanations on the wine labels.

Considering these findings, we may suggest to producers and state authorities to add some written information on the wine labels similar to the ones in other European countries, such as Italy, France or Spain stated by Annunziata et al., (2016). Since consumers clearly recognized the health benefits and perceived them as important, this fact may be used for future health claims legislations and regulations that will provide positive statements on the wine labels indicating healthiness of moderate wine consumption. Therefore this study might be used as scientific evidence for developing further health claims for wine and for producers to create health enhancing properties of wines (wines with enhanced resveratrol). Possible use of this survey may be found additionally in creations of packages and/or labels which may boost the positive perception of wine and boost its perceived health benefits. Implicit visual images may attract more consumers to buy wine and use it more often as part of healthy behaviour.

Conclusions

The survey on moderate wine consumption in Croatia has indicated that in general wine is perceived in a positive sense as a natural and healthy beverage. The positive effects were expressed through positive wine health benefits and positive wine quality perceptions, while risks were perceived by certain health risks.

Our survey was country specific and may be diverse in other countries due to differences in cultural and societal background, consuming patterns which originate from cultural influences of wine consumption, traditional diets that contain wine, societal influence of wine connected to social occasions (festivities, family gatherings). This survey, although specific may be useful for future wine surveys in the Mediterranean area, where wine is considered as part of balanced diet and healthy life style.

Due to the fact that Croatian consumers appreciated health benefits of wine to improve their health status, and/or reduce health risks/diseases in the future, a correct communication of these effects should be addressed in public, trust and credibility of expected benefits should be highlighted and existing product safety remained.

For the ongoing discussions at the legal authorities on the European and Croatian state level about the safety of agricultural products, this survey might be used as one of the guidelines. The existing regulations that define wine in Croatia as a food item should remain and may be improved by regulations that state both positive and negative effects of wine on human health expressed on wine labels and packages.

Acknowledgements

This work has been supported by the Croatian Science Foundation under the project „Influence of different vinification technologies on the qualitative characteristics of wines from Croatian autochthonous varieties: the role of wine in human diet “ VINUM SANUM (IP-2018-01-5049).

Authors contributions

CRediT roles: Anita Silvana Ilak Peršurić: Conceptualization, Investigation, Methodology, Formal analysis, Data curation, Writing – original draft; Sara Rossi: Writing – review & editing. Ena Bestulić: Writing – review & editing. Sanja Radeka: Resources, Writing – review & editing, Supervision, Project administration.

Conflict of interests

The authors declare no conflict of interest. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

1. Anekonda, T.S. (2006). Resveratrol – a boon for treating Alzheimer's disease? *Brain Research Review*, 52(2), 316-326 https://doi: 10.1016/j.brainresrev.2006.04.004
2. Annunziata, A., Pomarici, E., Vecchio, R., & Mariani A. (2016). Nutritional information and health warnings on wine labels, Exploring consumer interest and preferences. *Appetite,* 106, 58-69. https://doi:10.1108/BFJ-08-2015-0300
3. Ares, G., de Salmando, L., Giménez, A., Claret, A., Cunha, L.M., Guerrero, L., de Moura A.P., Oliviera, D.C.R., Symoneaux, R., & Deliza R. (2015). Consumers' associations with well-being in a food-related context: A cross-cultural study. *Food Quality and Preference,*40,304-341 https://dx.doi.org/10.1016/j.foodqual.2014.06.001
4. Barriero-Hurlé, J., Colombo, S., & Cantos-Villar E. (2008). Is there a market for functional wines? Consumer preferences and willingness to pay for resveratrol-enriched wines. *Food Quality and Preference,* 19(4), 360-371. https://doi:10.1016/j.foodqual.2007.11.004
5. Bernabéu, R. Díaz, M., Olivas, R., & Olmeda M. (2012). Consumers preferences for wine applying the best-worst scaling: a Spanish case study. *British Food Journal,* 21(1), 64-78. https://doi.org/10.1108/00070701211258790
6. Corduas, M., Cinquanta, L., & Ievoli, C. (2013). The importance of wine attributes for purchase decisions: A study of Italian consumers' perception. *Food Quality and Preference,* 28, 407-418. https://dx.doi.org/10.1016/j.foodqual.2012.11.007
7. Diener, E., Suh, M., Lucas, R.E., & Smith H.L (1999). Subjective Well-Being: Three Decades of Progress. *Psychological Bulletin,* 125(2), 276-302. https://doi.org/10.1037/0033-2909.125.2.276
8. Diener, E., Scollon, C.N., & Lucas, R.R. (2003). The evolving concept of subjective well-being: The multifaceted nature of happiness. *Advances in Cell Ageing and Gerontology,* 15, 187-219. https://doi.org/ 10.1016/S1566-3124(03)15007-9.
9. Dupuy, H. J. (1978). General Well-Being Schedule (GWB) [Database record]. APA Psyc Tests. https:// doi:10.1037/t04083-000
10. Eurocare, European Alcohol Policy Alliance (2013). Report: What is in Your bottle Alcohol ingredients labelling, Retrieved from https://www.eurocare.org/media/GENERAL/docs/reports/whatisinyourbottleeurocarelabellingreview2013.pdf (July 10, 2022)
11. Eurocare, European Alcohol Policy Alliance (2014). Report: What's not on the bottle, Retrieved from https://www.eurocare.org/media/GENERAL/docs/reports/2014novwhatsnotonthebottleeurocarereflectionsonalcohollabelling.pdf (July 10, 2022)
12. Flechteur-Mors, M., Biesalski, H.K., Jenkinson, C.P., Adler, G., & Ditshnet, H.H. (2004). Effects of moderate consumption of white wine on weight loss in overweight and obese subjects. International *Journal of obesity related Metabolic disorders,* 28, 1420-1426. https://doi:10.1038/sj.ijo.0802786

13. Fiore, M., Aliamo, L.S., & Chkhartisvil N. (2019). The amazing bond among wine consumption, health and hedonistic well-being. *British Food Journal,* 122(8), 2707-2723. doi.10.1108/BFJ-05-2019-0344

14. Goldberg, I.J., Mosca, L., Piano, M.R., & Fisher E.A. (2001). Wine and Your Heart, *Circulation,* 103, 472-475. https://doi.org/10.1161/01.CIR.103.3.472

15. Grunnert K.G., Bech-Larsen T., & Bredahl L. (2000). Three issues in consumer quality perception and acceptance of dairy products. *International Diary Journal,* 10, 575-584. https://doi.org/PII:S0958-6946(00)00085-6

16. Guiford, J.M., & Pezzuto, J.M (2011). Wine and health: A review. *American journal of viticulture and Enology,* 62(4), 471-486. https://doi.org:10.5344/ajev.2011.11013

17. Guirrero, L., Claret. A., Verbeke, W., Enderli, G., Zakowska-Biemans, S, Vanhonacker, F. Issanchou, S., Sajdakowska, M., Signe Granlie, B., Scalvedi, L, Contel, M., & Hersleth, M. (2010). Perception of traditional food products in six European regions. *Food Quality and preference,* 21, 225-233. https://doi:10.1016/j.foodqual.2009.06.003

18. Guilemin, I., Marrel, A., Arnould, B., Capuron, L., Dupuy, A., Ginon, E., Layé, S., Lecerf, J.M., Prost, M., Rogeaux, M., Urdapilleta, I., & Allaert, F.A. (2016). How French subjects describe well-being from food and eating habits? Development, item reduction and scoring definition of the Well-Being related to Food Questionnaire. *Appetite* 96, 333-346. dx.doi.org/10.1016/j.appet.2015.09.021

19. Gutiérrez-Escobar, R., Aliaño-González, M. J., & Cantos-Villar, E. (2021). Wine Polyphenol Content and Its Influence on Wine Quality and Properties: A Review. *Molecules,* 26(3),718. https://doi.org/10.3390/molecules26030718

20. Jovanović A., & Cvetković Atanasovska A. Wine as a agricultural food product: A historical and comparative legal approach. *Ekonomika poljoprivrede-Economics of agriculture*, 2:517-532, doi:10.5937/ekoPolj2202517J

21. Khalil, A., & Tazeddinova, D. (2020). The upshot of polyphenolic compounds on immunity amid COVID-19 pandemic and other emerging communicable diseases: An appraisal. *Natural Products and Bioprospecting*, 10(6), 411-430. https://doi.org/10.1007/s13659-020-00271-z

22. Higgins, L.M., & Llanos, E. (2015). A healthy indulgence? Wine consumers and the health benefits of wine. *Wine Economics & Policy*, 4(1), 3-11. https://doi.org/10.1016/j.wep.2015.01.001

23. Hristov, H., & Kuhar, A. (2015). Subjective knowledge as a determinant of young adult consumers wine behavior. *British food Journal*, 117(12), 2930-2946 https://doi.org/10.1108/BFJ-04-2015-01636

24. Ilak Peršurić, A.S. (2020). Segmenting Olive Oil Consumers Based on Consumption and Preferences toward Extrinsic, Intrinsic and Sensorial Attributes of Olive Oil. *Sustainability*, 12(16), 6379, https://doi:10.3390/su12166379

25. Ilak Peršurić, A.S., & Mann, S. (2019). What distinguishes connoisseurs from spenders? A case study of wine in Croatia. *Ekonomika poljoprivrede-Economics of Agriculture,* 66(4), 929-940. doi.org/10.5937/ekoPolj1904929I

26. Kaur, N., & Singh P. (2017). Deciphering the consumer behaviour facets of functional foods: A literature review. *Appetite,* 112, 167-187. https://dx.di/10.1016/j.apett.2017.01.033

27. Maechle, N., Iversen, N., Hem, L., & Otnes C. (2015). Exploring consumer preferences for hedonic and utilitarian food attributes. *British Food Journal*, 117(12), 3039-3063. https://doi.org//10.1108/BFJ-07-2015-0267

28. Magrone, T., Candore, G., Caruso, C., Jerillo, E., & Covelli, V. (2008). Polyphenols from red wine modulate immune responsiveness: bio-logical and clinical significance. *Current Pharm. Res*., 14, 2733-2748. https://doi: 10.2174/138161208786264098

29. Plunk, A. D., Syed-Mohammed, H., Cavazos-Rehg, P., Bierut, L. J., & Grucza, R. A. (2014). Alcohol Consumption, Heavy Drinking, and Mortality: Rethinking the J-Shaped Curve. *Alcoholism: Clinical and Experimental Research*, 38(2), 471–478. https://doi.org/10.1111/acer.12250

30. Qi, C.-C., Ge, J.-F., & Zhou, J.-N. (2015). Preliminary evidence that abscisic acid improves spatial memory in rats. *Physiology & Behavior*, 139, 231-239. https://doi.org/10.1016/j.physbeh.2014.11.053

31. Reale, M., Constantini, E., Jagarlapoodi, S., Khan, H., Belwal T., & Cichelli A. (2020). Relationship of Wine Consumption with Alzheimer's Disease. *Nutrients,* 12, 206. https://doi:10.3390/nu12010206

32. Renaud, S., & de Lorgeril, M. (1992). Wine, alcohol, platelets and the French paradox for coronary heart disease. *Lancet,* 20(339-8808), 1523-1526

33. Rioninen, K., Lähteenmäki, L., & Tuorila, H. (1999). Quantification of the consumer's attitude towards health and the hedonic characteristics of foods. *Appetite,* 33, 7188. https://doi:10.1006/appe.1999.0232

34. Rizzo, G., Borrello, M., Guccione, G.D., Schifani, G., & Cembalo, L. (2020). Organic Food Consumption: The Relevance of the Health Attribute. *Sustainability*, 12, 595. https: //doi:10.3390/su12020595

35. Ruf, J. C. (2003). Overview of epidemiological studies on wine, health and mortality. *Drugs Under Experimental and Clinical Research*, 29(5–6), 173–179

36. Saba, A., Sinesio, F., Moneta, E., Dinella, C., Laureati, M., Torri, L., Peparo, M., Saggia Civiteli, E., Endrizzi, I., Gasperi, F., Bendini, A., Gallina Toschi, T., Predieri, S., Abba, S., Bialetti, L., Proserpio, C., & Spinelli S. (2019). Measuring consumers attitudes towards health and taste and their association with food related life-styles and preferences. *Food Quality and Preference*, 73, 25-37. https:// doi.org/10.1016/j.foodqual.2018.11.017

37. Samoggia, A. (2016). Wine and health: faraway concepts? *British Food Journal*, 118, 946-960. https://doi: 10.1016/j.wep.2017.04.001

38. Shen, J., Wilmot, K.A., Ghasemzadeh, N., Molloy, D.L., Burkman, G., Mekonnen, G., & Sperling L.S. (2015). Mediterranean dietary patterns and cardiovascular health. *Ann. Rev. Nutr.,* 35, 425-449. https://doi.org/10.1146/annurev-nutr-011215-025104

39. Vecchio, R., Decordi, G., Gressillon, L., Gugenberger, C., Maheo, M., & Jourjon F. (2017). European consumers' perception of moderate wine consumption on health. *Wine Economics and policy,* 6, 14-22. https://dx,doi.org/10.1016/j.wep.2017.04.001

40. Vaquero, M.J.R., Alberto, M.R., & de Nadra, M.C.M. (2007). Antibacterial effect of phenolic compounds from different wines. *Food Control*, 18(2), 93-101. https://doi.org/10.1016/j.foodcont.2005.08.010

41. Verdú Jover, A.J., Llores Montes, F.J., & del Mar Fuentes Fuentes, M. (2003). Measuring perceptions of quality in food products: the case of red wine. *Food Quality and Preference,* 15, 453-469. https://doi:10.1016/j.foodqual.2003.08.002

42. Willcox, D.C., Scapagnini, G., & Willcox, B.J. (2014). Healthy ageing diets other than the Mediterranean: A focus on the Okinawan diet. *Mechanisms of ageing and Development,* 136-137(148-162). https://dx.doi.org/10.1016/j.mad.2014.01.002

43. Yabin, A., & Li, J. (2019). Segmentation of China's online wine market based on the wine-related lifestyle. *British Food Journal*, 0007-070X, https://doi.10.1108/BFJ-04-2019-0925

44. Zakon o vinu, Republika Hrvatska (Narodne novine, br.32/19), [in English: Law on Wine "Official Gazette of the Republic of Croatia", No.32/19] available at: https://www.zakon.hr/z/277/Zakon-o-vinu

APPENDIX

Table 1. Market wines consumers groups - grades for wine items

Wine type* / **Item**	**MF**	**MA**	**TF**	**TA**	**PF**	**PA**	**PMF**	**PMA**	**S**
Rest after work	-0,57 ± 0,79**ab**	0,29 ± 0,95**a**	-0,29 ± 0,95**ab**	-1,43 ± 2,44**b**	0,14 ± 0,38**a**	0,14 ± 1,95a	0 ± 0,58**a**	0 ± 0**a**	
Natural beverage	-0,57 ± 1,4**b**	0,14 ± 0,69**ab**	0,71 ± 1,38**a**	-1 ± 1,73**b**	0,14 ± 0,38**ab**	0,57 ± 1,27**ab**	0 ± 0,58**ab**	0,13 ± 0,83**ab**	
General positive benefits	0,43 ± 2,44**a**	0,43 ± 0,79 **a**	0,43 ± 0,53 **a**	-1,14 ± 1,68**b**	0,29 ± 0,49 **a**	0,71 ± 1,6 **a**	0,29 ± 0,76 **a**	0,25 ± 0,71 **a**	
Rise of mood	-0,14 ± 1,46**ab**	0,86 ± 1,07**a**	0,14 ± 1,35 **ab**	-1 ± 1,41**b**	-0,14 ± 1,07 **ab**	0,29 ± 1,89 **ab**	0,57 ± 1,27**a**	0 ± 1,41 **ab**	
Body weight	-0,43 ± 0,98	0,14 ± 1,57	-0,57 ± 0,98	-0,57 ± 1,27	0,57 ± 0,98	0,57 ± 1,13	0,14 ± 0,9	0,38 ± 0,74	ns
Psychical condition (energy)	0,29 ± 1,25 **ab**	-0,29 ± 1,25 **ab**	0,14 ± 1,07 **ab**	-0,86 ± 1,57**b**	0,29 ± 0,95 **ab**	0,29 ± 1,89 **ab**	-0,14 ± 1,35 **ab**	0,75 ± 0,89**a**	

Wine type* / Item	MF	MA	TF	TA	PF	PA	PMF	PMA	S
Pregnancy	0,14 ± 1,46**a**	-0,14 ± 1,95 **ab**	0,71 ± 0,49 **a**	-1,57 ± 2,15 **b**	0,57 ± 0,79 **a**	1,43 ± 1,72 **a**	0,14 ± 1,21 **a**	0,38 ± 1,6 **a**	
Micro region	-1,14 ± 1,95**c**	-0,14 ± 0,69**abc**	0,57 ± 0,98**a**	-1 ± 2,16**bc**	0,43 ± 1,72**ab**	1 ± 1,41**a**	-0,14 ± 1,35**abc**	0 ± 0,76**abc**	
Quality (PGI/PDO)	-0,71 ± 1,38**bc**	0,57 ± 0,98**ab**	0,29 ± 1,11**ab**	-1,43 ± 1,9**c**	0,14 ± 1,07**ab**	0,71 ± 1,5**a**	0 ± 0,58**ab**	0,25 ± 0,71**ab**	

Differences for items on start/end of moderate wine consumption: differences low case letter represent statistical significant differences (S) between groups at $p<0.05$ level obtained by one way Anova. *Source:* Authors' calculations

Table 2. Correlations of feeling anxious and health benefits of wine

Feeling anxious and health benefits of wine	Wine type*	χ^2	dF	Cc	p
General positive benefits	MF	18.4	8	0.644	0.018
	MC	9.7	3	0.604	0.021
Rise of mood	MF	17.9	8	0.639	0.022
	M7B	12.1	6	0.634	0.050
	MF	8.5	3	0.579	0.036
	TM7	13.4	6	0.654	0.037
Positive for hart health	MC	10.5	4	0.619	0.032
	TM7	12.4	6	0.640	0.050
Positive for memory	MC	10.5	4	0.619	0.032
Positive for neurovegetative diseases	MF	25.2	8	0.702	0.001
	MC	10.5	3	0.619	0.014
Blood sugar levels	MF	18.1	8	0.641	0.020
	M7B	15.6	8	0.682	0.047
Body weight	M21	15.3	8	0.711	0.050
	M7B	16.5	8	0.692	0.036
	TM10B	15.8	8	0.665	0.044
Psychical condition (energy)	M21	16.7	8	0.726	0.033
Metabolism	M7B	19.8	8	0.724	0.011

Source: Authors' calculations

Table 3. Correlations of feeling nervous v.s health benefits of wine

Feeling nervous and health benefits of wine	Wine type*	χ^2	dF	Cc	p
Rest after work	MF	31.0	12	0.738	0.002
	M21	18.1	9	0.740	0.033
	M1	21.8	12	0.750	0.039
I consume wine as part of healthy lifestyle	M21	16.3	9	0.722	0.050
	M1	25.7	12	0.776	0.012
General positive benefits	MF	35.9	12	0.762	0.000
	M21	17.0	9	0.729	0.048
Hart health	M21	19.6	9	0.753	0.020
	TM10B	22.2	12	0.726	0.035

Feeling nervous and health benefits of wine	Wine type*	χ^2	dF	Cc	p
Blood vessels health	M21	19.8	9	0.755	0.019
	TM10B	22.2	12	0.726	0.035
Psychological health and memory	M21	25.0	12	0.791	0.015
	TM10B	27.0	12	0.758	0.008
Neurological diseases	MF	28.2	12	0.722	0.005
Blood sugar levels	M1	21.9	12	0.750	0.039
Cholesterol levels in blood	MF	21.3	9	0.671	0.021
	M21	22.0	4	0.771	0.035
	M7	9.9	4	0.618	0.042
	M7	9.1	8	0.603	0.003
	TM10B	22.8	12	0.730	0.030
Body weight	M21	30.3	12	0.818	0.003
	MP	9.4	4	0.622	0.050
Psychical condition (energy)	M21	31.7	12	0.824	0.002
	MM7B	20.7	12	0.732	0.055

Source: Authors' calculations

Table 4. Correlations of feeling under pressure v.s health benefits of wine

Feeling under pressure/stressed and health benefits of wine	Wine type*	χ^2	dF	Cc	p
Rest after work	MC	16.8	8	0.706	0.032
Rise of mood	MF	24.4	12	0.696	0.018
	TPHTB	15.6	6	0.692	0.016
Wine is a natural beverage	M7B	21.0	12	0.734	0.050
	MC	20.6	9	0.741	0.014
I consume wine as part of healthy life style	PF	22.4	12	0.785	0.033
	TM21	16.7	9	0.727	0.050
General positive benefits	TM10	8.0	2	0.707	0.018
	MC	19.7	9	0.733	0.019
Hart health	TAN	18.5	6	0.722	0.005
	M7B	20.9	12	0.733	0.050
Blood vessels health	MC	18.1	6	0.719	0.006
	M7B	1.6	12	0.739	0.042
Psychological health and memory	M7B	21.6	12	0.711	0.042
Neurological diseases	MC	14.4	6	0.678	0.025
Cholesterol levels in blood	MC	13.7	6	0.669	0.033
	M1	18.6	9	0.723	0.028
	PA	21.3	12	0.788	0.045
Body weight	M7B	24.2	12	0.757	0.019
Psychical condition (energy)	M1	22.2	12	0.753	0.035
	M7B	25.8	12	0.768	0.011

Source: Authors' calculations

Table 5. Correlations of feeling good – happy v.s health benefits of wine

Feeling good-happy and health benefits of wine	**Wine type***	χ^2	**dF**	**Cc**	**p**
Rest after work	TAN	12.0	16	0.644	0.000
	MC	17.0	9	0.729	0.048
Rise of mood	TM21	5.4	6	0.677	0.047
General positive benefits	M21B	25.7	12	0.776	0.012
	M7	9.9	4	0.619	0.042
	TAN	25.7	16	0.776	0.050
Blood vessels health	TPHTB	19.2	9	0.729	0.023
Psychological health and memory	TM21	14.9	8	0.643	0.050
Neurological diseases	MC	16.4	9	0.701	0.050
Blood sugar levels	TA	18.6	9	0.509	0.029
Neurological diseases	MC	16.4	9	0.701	0.050
Body weight	LH	21.0	12	0.764	0.050

Source: Authors' calculations

*The Malvazija istarska wines were produced in vinification treatments: (MC) control treatment without maceration, (TAN) treatment without maceration with the addition of tannin, (M1) pre-fermentatitive cold 1-day maceration, (M7) 7 days maceration, (M21) 21 day maceration and (LH) late harvest grape vinification. Three of these wines were aged in barrique barrels and named M7B, M21B, LHB.

The Teran wines were produced in vinification treatments: TPHT 48h prefermenative heating at 45 degrees, followed by 8 day clasical maceration, (TM7) control treatment with 7 days of maceration, (TM10) prolonged 10 day maceration, (TM21) prolonged post-fermentative 21 day maceration. These wines were aged in barrique barrels and named TPHTB, TM7B, TM10B, TM21B.

The wines bought from the open market were MF (Malvazija fresh), MA (Malvazija aged), TF (Teran fresh), TA (Teran aged), PF (Pošip fresh), PA (Pošip aged), PMF (Plavac fresh), PMA (Plavac aged).

GASTRONOMY AS AN EFFECTIVE TOOL FOR RURAL PROSPERITY – EVIDENCE FROM RURAL SETTLEMENTS IN REPUBLIC OF SERBIA

Jovan Bugarčić[1], Drago Cvijanović[2], Dragan Vukolić[3], Miloš Zrnić[4], Filip Đoković[5], Tamara Gajić[6]

**Corresponding author E-mail: tamara.gajic.1977@gmail.com*

ARTICLE INFO

Original Article

Received: *28 October 2022*

Accepted: *22 December 2022*

doi:10.59267/ekoPolj2301169B

UDC 338.48-6:316.334.55(497.11)

Keywords:

gastronomy, rural settlements, tourism, Republic of Serbia

***JEL**: R23, Z32*

ABSTRACT

Food and gastronomy certainly occupy a special position in rural promotion. The aim of the research was to determine to what extent the local population believes that the gastronomic offer affects rural prosperity. The results show that all the factors of the tourist offer are of satisfactory quality and have a significant influence in predicting the rural development of countryside in Serbia, and that respondents in the middle age category believe that gastronomy determines rural prosperity. Material status has no statistical significance in the difference in the perception of the impact of gastronomy on rural development, but in relation to the age category, results show a statistically significant difference. The research has an obvious importance in the theoretical and applied aspect, as a complement to the existing literature, as well as an aid in the strategic planning of the development of rural settlements in Serbia.

1 Jovan Bugarčić, MSc, Faculty of Hotel Management and Tourism University of Kragujevac, Vojvođanska 5a, 36210, Vrnjačka Banja, Serbia. E-mail: bugarcicjovan@gmail.com, ORCID ID (https://orcid.org/0000-0002-6104-2939)

2 Drago Cvijanović,PhD, Faculty of Hotel Management and Tourism University of Kragujevac, Vojvođanska 5a, 36210, Vrnjačka Banja, Serbia, E-mail: dvcmmv@gmail.com, ORCID ID (https://orcid.org/0000-0002-4037-327X)

3 Dragan Vukolić, MSc, Faculty of Hotel Management and Tourism University of Kragujevac, Vojvođanska 5a, 36210, Vrnjačka Banja, Serbia. University of Business Studies, Faculty of Tourism and Hotel Management, Banja Luka, Bosnia and Herzegovina, E-mail: vukolicd@gmail.com, ORCID ID (https://orcid.org/0000-0002-6364-9849)

4 Miloš Zrnić, MSc, Academy of Applied Studies – The College of Hotel Management, Kneza Višeslava 70, 11000 Belgrade, Serbia, E-mail: milos.zrnic@vhs.edu.rs, ORCID ID (https://orcid.org/0000-0003-3454-6573)

5 Filip Đoković, PhD, College of Organizationl Studies - EDUKA, 11000 Belgrade, Serbia, Phone: + 381 64 648 32 03, E-mail: fdokovic@vos.edu.rs, ORCID ID (https://orcid.org/0000-0002-2342-9358)

6 Tamara Gajić, Geographical Institute "Jovan Cvijić" SASA, Belgrade 11000, Serbia. South Ural State University, Institute of Sports, Tourism and Service, Chelyabinsk, Russia. Faculty of Hotel Management and Tourism University of Kragujevac, Vojvođanska 5a, 36210 Vrnjačka Banja, Serbia, E-mail: tamara.gajic.1977@gmail.com, ORCID ID (https://orcid.org/0000-0003-3016-8368)

Introduction

When considering the term rural environment, there are difficulties in choosing the definition itself and determining what the term rural environment actually means. Certainly, the rural territory is the one where the space is used primarily for the production of food, but if viewed from a sociological point of view, it is a space that is at a lower level of development compared to the technological and cultural development in the urban environment (Gajić et al., 2022c). The Republic of Serbia is said to be a rural country, due to the huge rural areas it possesses, but also a large number of natural resources outside urban areas. The connection between tourism and rural development has been studied from many aspects for many years (Vukolić et al., 2022). Tourism is becoming traditionally linked to rural development, and all tourist activities, including gastronomy, are considered an economic addition to rural areas. As a kind of medicine for the recovery of rural areas, tourism and gastronomy are placed in the first place as its important segment.

The main goal of this research is to determine whether gastronomy, together with other tourist offers, is a good tool for improving rural areas. In this connection, two research questions were asked, which will receive their answer along with the confirmation of the corresponding hypotheses.

R.Q.1 - Is the quality of the entire tourist offer at a satisfactory level?

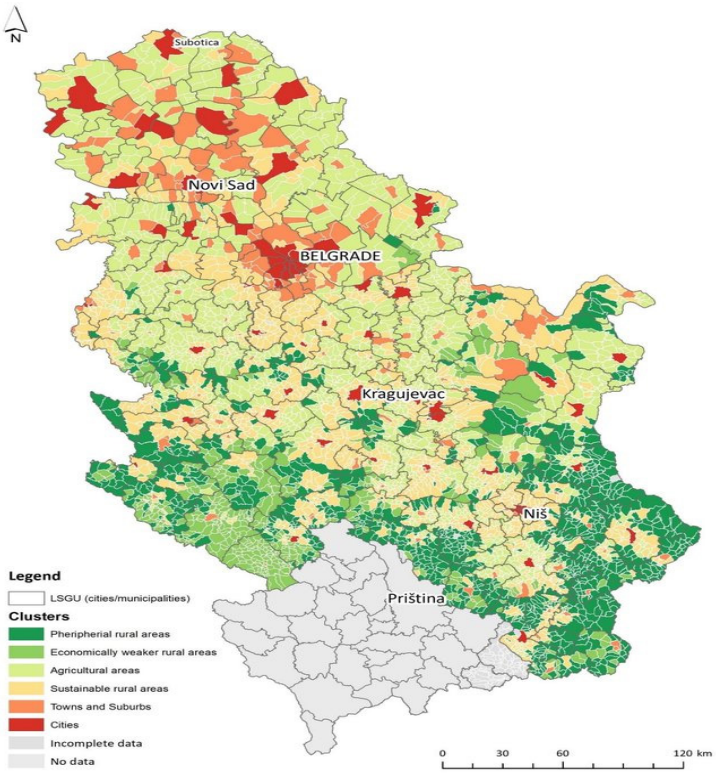
R.Q.2 - Can specific rural gastronomy contribute to rural prosperity?

In order to achieve this goal, research was conducted on a total sample of 534 respondents in 10 rural municipalities on the territory of Serbia. The research was conducted in the period from April to July 2022, by distributing a standard questionnaire to the local population in the given rural municipalities. SPSS software, version 26.00, was used for data analysis. Then, with the help of factor analysis items, a total of 6 factors were obtained, and multiple regression analysis determined whether there is an influence of factors on rural prosperity. The obtained results showed that each of the mentioned factors statistically significantly predicts rural prosperity, as well as that material status or monthly earnings do not show a statistical difference in the perception of the impact of gastronomy on rural development. Survey participants in the age group of 30 to 65 years, to the greatest extent believe that specific rural gastronomy will have an impact on rural property. There were certain limiting circumstances during the field research, primarily when surveying the local village population. A large number of them did not want to cooperate with the researchers because of the fear of the COVID-19 pandemic, which is still present. The research has wider social, economic and scientific significance, both in supplementing the existing literature, which is evidently scarce for this topic in Serbia, and also in supplementing strategic measures for the improvement of tourism business, which is an important segment of the development of rural settlements in Serbia.

Literature review

Republic of Serbia has always been rich in natural resources, and the villages of Serbia are considered a potential tourist offer, precisely because of the very weak offer on the tourist market (Božović et al., 2021). Rural settlements become an attractor for tourists, especially in conditions when there was a pandemic, and the local population was looking for a place to escape from urban areas, and to avoid closure during the restrictive measures that had to be observed in certain periods of the previous two and a half years (Blešić et al., 2022). However, foreign tourists are also looking for vacations in rural areas, especially those that are poorly explored and have different natural beauty than what has already been seen in Europe and the world (Kirolova and Hamarnech, 2017; Lakićević et al., 2023). Therefore, Serbia has a huge potential for the future of tourism development, primarily by offering untouched rural areas, where, in addition to enjoying nature, tourists can get to know the tradition, culture, history of the Serbian people and all minorities in this area, but also participate in rural activities provided by rural households (Gajić et al.,2022a,c,d). Rural development is seen as a process of improvement of all sectors from economic to social well-being of rural settlements (Alonso et al., 2017).

Figure 1. Map of rural areas on the territory of Serbia

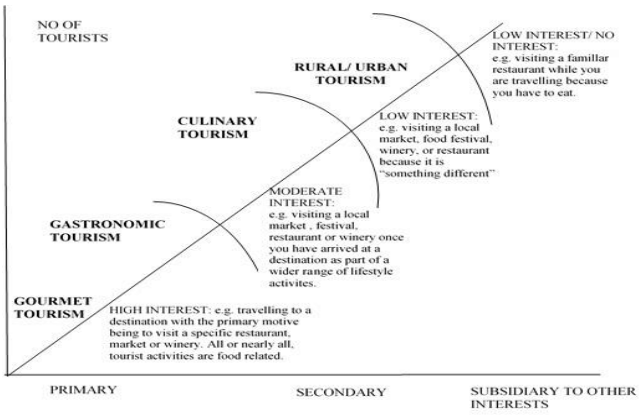


Source: Gajić et al., 2021.

Rural development includes a set of local culture and heritage that includes gastronomy, then old crafts, traditional art, village history, landscapes and related flora and fauna (Lee et al., 2016). Focusing on the offered gastronomy is a unique opportunity to explore the production potential and limitations of the current tourist offer in the rural areas of Serbia (Blešić et al., 2022).

Gastronomy is one of the elements incorporated into the new concept of development of tourism and public spaces, relying on the growing trends of a good lifestyle, authenticity, environmental protection and the need for a quality experience (Dougherty and Green, 2011). The need among tourists for food that reflects the heritage and culture of the place, which helps preserve traditional forms of agriculture and cultural heritage, is emphasized (Mak etaal., 2012; Richards, 2015). In this context, gastronomy represents a major link in the relationship between tourism and rural development (Cohen and Arieli, 2004). The national cuisine of Serbia is certainly a form of cultural tourism and heritage (Gajić et al., 2022b). Food can be a great attractor when it comes to areas that are dying, such as rural areas. Food is used as a medium of interaction and cultural identity (Mitchell et al., 2012). Today, gastronomic tourism has become an important aspect of tourism to attract international tourists and many destinations use food as a source of attraction in their tourism marketing to differentiate and expand their market base (Lin et al., 2011). Not only is food a necessity, but also on the basis of tourism, it becomes a motivation for tourism (Prada – Trigo, 2017). As gastronomy is an essential part of travel it plays an important role in the visitor experience which helps to enhance the tourism experience, more than just as food (Sedarati, 2012). According to Quan & Wang (2004) gastronomy refers to the recognition of various factors relevant to the food and drink that a group eats and consumes in a place, region or even nation. Food is an essential part of all cultures and one of the elements of creativity in everyday life that is interesting for many visitors (Sims, 2009). Food is also an element that is easily associated with the tourism industry and contributes to economic development and improving the national image (Koloman and Koloman, 2014).

Figure 2. Food tourism as special interest tourism



Source: taken from Hall & Sharples (2003)

Gastronomy, as a tourist resource, is valued not only for its own sake, but also for its ability to generate rural development (McKercher, 2008). Gastronomic tourism helps to increase rural sources of income and improve income levels and employment of the local workforce (especially women) (Williams et al., 2014).

In relation to the problem of the research, the following hypotheses were set:

H1: The quality of factors of the tourist offer are at a satisfactory level.

H2a: Accommodation has impact on rural prosperity.

H2b: Specific rural gastronomy has impact on rural prosperity.

H2c: Intermediaries has impact on rural prosperity.

H2d: Environment and region have impact on rural prosperity.

H2e: Complementary activities have impact on rural prosperity

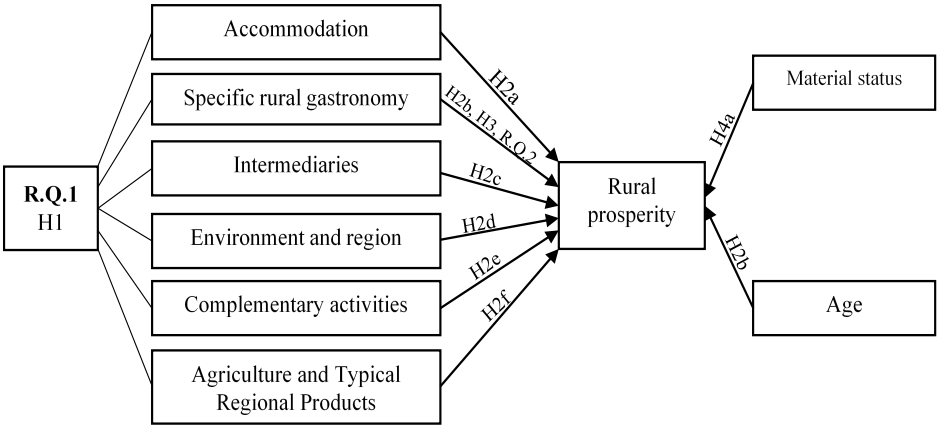
H2f: Agriculture and Typical Regional Products have impact on rural prosperity.

H3: Specific rural gastronomy has the greatest influence on rural prosperity

H4a: Material status shows a statistically significant difference in the perception of the influence of gastronomy on the development of rural settlements

H4b: Age shows a statistically significant difference in the perception of the influence of gastronomy on the development of rural settlements

Figure 3. Hypothesis setting



Source: author`s research

Methodology

Sample and procedure

The research was carried out in the period from April to July 2022, using the standard procedure of distributing questionnaires among the local population in 10 rural settlements in Serbia: Lopatnica, Rogljevo, Turija, Ključ, Leušići, Gornja Koviljača, Drežnik, Knić, Tulež, Kremna. The total number of respondents was 534. The questions were asked in Serbian, but the questionnaire was retranslated into English to ensure the original meaning of the questions.

Table 1. Socio-demographic characteristics and travel habits of respondents

Gender (%)			**Education (%)**	
Male	53.7%		*Elementary school*	11.8 %
Female	47.3%		*Secondary school*	30.8%
			Higher school/college	52.9%
Age (%)	*<35* *35-65*	30.4 37.6%	*Faculty/master/PhD*	4.5%
	65+	32%		
Material status (euro)				
	300-500 54.3%	*500-1.000* 32.7%	*>1.000* 13%	

Source: author`s research

A total of 53% of men and 47.3% of women participated in the research. The largest percentage of respondents is between the ages of 35 and 65 (37.6%), followed by a total of 32% aged over 65 and 30.4% under 35. A total of 11.8% have completed elementary school, followed by 30.8% with completed secondary school. In total, 52.9% of respondents with a college degree and 4.5% with a university degree participated, where both respondents with MSc and PhD degrees were included. When looking at the non-material statistics, the majority of research participants had an average income of 300 to 500 euros (54.3%), followed by 32.7% with an average of between 500 and 1,000 euros and only 13% with earnings over 1,000 euros.

The data used in the research analysis were collected by a questionnaire that consisted of 20 questions, which consisted of two parts. The first group of questions consisted of questions related to the sociodemographic structure of the respondents (age, gender, education, material status). The second part of the questionnaire contained questions related to all factors that will be given in the following paragraphs. Answers were measured on a five-point Likert scale (1-I totally disagree, 5 - I totally agree).

Measures

The model established by the author Güzel (2016) was used, with certain modifications of the questions from the given questionnaire. A total of 6 factors were determined with a very good reliability value for all items (α): A - Accomodation (Hotels α=0.734, Rural households α=0.893, Rural camps α= 0.870, Hostels α=0.894), SP- Specific rural gastronomy (Food α=0.850, Drink α=0.820, Domestic products α=0.844), I - Intermediaries (Tourist agencies α=0.889, Social medias α=0.800), ER -Environment and Region (Natural resources α=0.738, Cultural resources α=0.780, Social resources α=0.710), CA - Complementary Activities (Domestic workshops α=0.690, Entertainment α=0.690, Events α=0.789, Recreation and sports α=0.822), ATRP - Agriculture and Typical Regional Products (Alimentary Firms and Production Zones α=0.890, Wine Producers and Vineyards α=0.849), RP – Rural prosperity (Gastronomy affects the complete rural development α=0.769, Gastronomy contributes only to the promotion of domestic products α=0.791).

Data analysis

The obtained data were processed with SPSS software, version 26.00. Given the fact that all values are normally distributed, data processing was started through parametric analysis (Sk and Ku values ranged from -1.5 to 1.5). Descriptive statistical analysis was used to obtain average grades and values of arithmetic averages for each item. Then, exploratory factor analysis confirmed the number of factors and the percentage of explained variance, more precisely EFA was applied as a principal component analysis to check the factor structure. Representativeness was good (KMO = .914), and Bartlett's test of sphericity was significant ($\chi 2(66) = 6272.792$, $p < .000$), which confirmed that the data were suitable for further analysis.

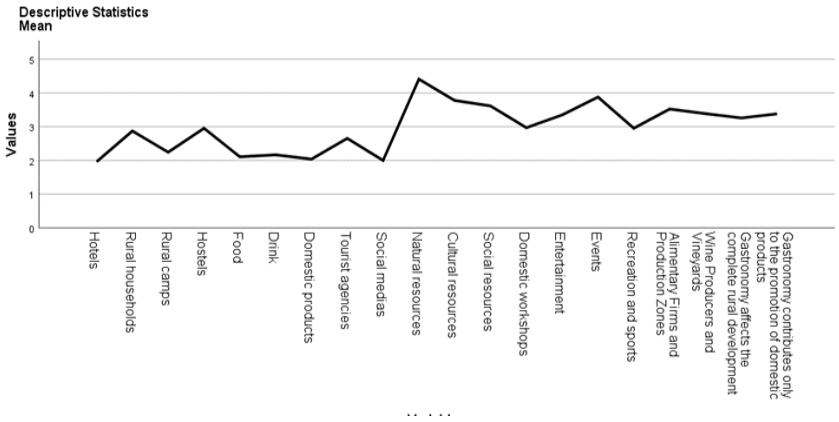
The problem of determining the influence of factors on the criterion variable Rural prosperity is a problem of one dependent and several independent variables, with a linear relationship, and the case is reduced to a multiple regression model. Also, in order to find out the differences in the perception of the impact of gastronomy on rural prosperity, in relation to age and material status, the authors used an analysis of variance - ANOVA.

Results and discussion

Descriptive statistical analysis

Figure 4. gives an insight into the average scores for all questions that are later grouped into 6 factors.

Figure 4. Display of average marks for all questions



Source: author`s research

It is noted that the items belonging to the Environment and Region factor, which includes natural, cultural and social resources, received the highest marks. Elements belonging to factor 1 Accomodations received the lowest marks. Items that belong to the factor of influence of gastronomy on rural development have an average score above 3. The item Social media, which belongs to factor 3 - Intermediaries, received the lowest average score below 2. The initial hypothesis H1, that all factors of the quality of the tourist offer are at a satisfactory level, was confirmed. The obtained results provide an answer to the first research question of R.Q. 1 that the quality of the offer is at a satisfactory level.

Factor extraction

Given that all model fit parameters were adequate (KMO and Bartlett's test of sphericity), a further EFA analysis was undertaken. Factor analysis confirmed that all items are grouped into 6 factors, with an explained variance of 73.3%. Promax rotation was applied since the extracted components were correlated. Horn's parallel analysis confirmed the acceptance of 6 factors (Horn, 1965). The first factor has the highest percentage of saturation and explains the highest percentage of variance, 41.2%, while the other factors explain slightly less percentage of variance, going towards the last one, which explains 3.8%. The factor structure matches the number of factors from the model taken from the author Güzel (2016).

Table 2. Results of factor extraction – EFA analysis

Extraction Sums of Squared Loadings		**Rotation Sums of Squared Loadings[a]**
% of Variance	Cumulative %	Total
41.219	41.219	6.588
11.706	52.926	5.407
6.994	59.920	5.527

Extraction Sums of Squared Loadings		Rotation Sums of Squared Loadings[a]
5.591	65.510	4.017
3.981	69.492	1.023
3.864	73.355	1.224

Extraction Method: Principal Component Analysis.
[a]When components are correlated,
sums of squared loadings cannot be added to obtain a total variance.

Source: author`s research

Results of multiple regression analysis

According to the obtained results of the multiple regression analysis, it was determined that the percentage of the variable explained by the model was 61.7% (R2 = 61.7%, F=141.349, df =6, p=0.00).Table 3 shows the data of the multiple regression analysis, where the significance of the influence of all factors on rural development is observed. It is observed that all the mentioned factors show a statistically significant influence on the prediction of rural development. The value of b is for each factor in a positive direction, which means that they have an influence on the prediction in the same direction (the more significant the factor, the more significant the prediction).

Table 3. Regression model - presentation of the influence of factors on rural development

Model	B	Std.Error	Beta	t	Sig.
(Constant)	-.259	.181		-1.433	.153
Accommodation	.063	.076	.035	.828	.008
Specific gastronomy	.020	.067	.012	.303	.042
Intermediaries	.096	.058	.061	1.642	.001
Environment and region	.128	.050	.092	2.558	.011
Complementary activities	.209	.045	.198	4.670	.000
Agriculture and Typical Regional Products	.569	.038	.537	15.059	.000

Criterion variable: Rural prosperity

Source: author`s research

These results confirmed the hypotheses: H2a, H2b, H2c, H2d, H2e and H2f, that all factors have an impact on rural prosperity. Also, it was established that specific rural gastronomy affects rural prosperity, but not to the greatest extent, and hypothesis H3 is partially explained.

Determining differences in the perception of the impact of gastronomy on rural prosperity – ANOVA

With the help of analysis of variance, it was determined whether there are differences in the opinions of respondents about the impact of gastronomy on rural prosperity in relation to demographic characteristics, age and financial status (Table 5).

Table 5. Results of analysis of variance

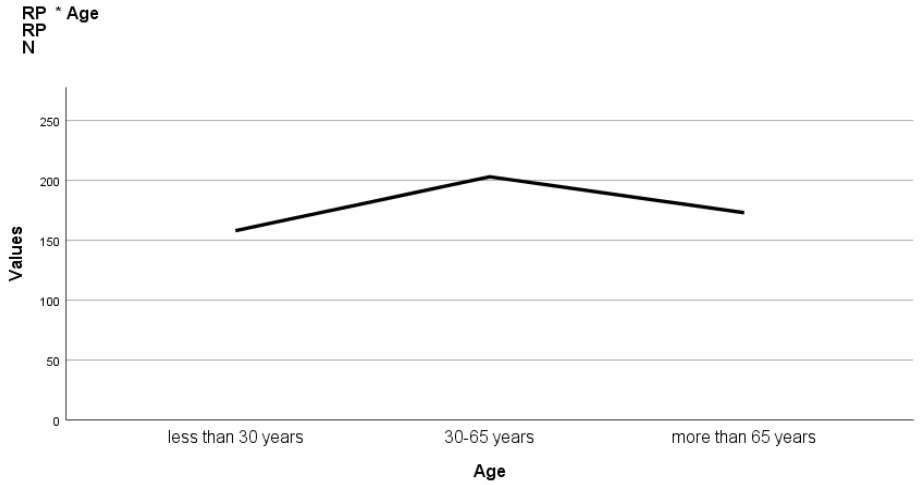
				95% Confidence Interval	
(I) M.status	**(J) M.status**	**Mean Difference (I-J)**	**Sig.**	**Lower**	**Upper**
Low	Average	3.24411*	.063	.0724	6.4158
	High	2.82308	.106	-.3902	6.0363
Average	Low	-3.24411*	.063	-6.4158	-.0724
	High	-.42103	.266	-1.0136	.1715
High	Low	-2.82308	.106	-6.0363	.3902
	Average	.42103	.266	-.1715	1.0136
(I)Age	**(J) Age**	**Mean Difference (I-J)**	**Sig.**	**95% Confidence Interval Lower**	**Upper**
Less than 30 years	30-65 years	-.53850*	.018	-1.0083	-.0687
	More than 65 years	.31057	.379	-.1767	.7978
30-65 years	Less than 30 years	.53850*	.018	.0687	1.0083
	More than 65 years	.84907*	.000	.3909	1.3072
More than 65 years	Less than 30 years	-.31057	.379	-.7978	.1767
	30-65 years	-.84907*	.000	-1.3072	-.3909

*. The mean difference is significant at the 0.05 level.

Source: author`s research

The ANOVA test showed that there are statistically significant differences in the answers about the influence of gastronomy on rural prosperity in relation to the demographic categories of the year and material status. The values of the test for material status are: df=2, F=4.380, p=0.73, and for the age category: df=2, F=10.262, p=0.000. Table I on the graph shows that material status does not affect the respondents' perception of the importance of gastronomy on rural prosperity. Hypothesis H4a was negated, and hypothesis H4b was confirmed due to the perceived value of the existing differences in the answers in the category of age or years. Respondents between the ages of 30 and 65 emphasize differences in the perception of the impact of gastronomy on rural prosperity in comparison to other age groups of respondents. The accuracy of the established differences in the focus category is shown in figure 5.

Figure 5. Display of differences in response in relation to age



Source: author`s research

Conclusion with limitations and future implications

The increasing demand of modern tourists for rural areas, local tradition and culture, as well as the desire for community involvement provides opportunities for the economic revitalization of rural areas (Alonso et al., 2017). Gastronomy can be the driving force behind the sustainable economy of rural areas and social inclusion in the overall economic development (Gajić et al., 2022a). In many rural settlements, incomes from the cultivation of agricultural crops are decreasing, so the contribution to the development of those areas would definitely be tourism in any form, including gastronomic tourism (Cvijanović et al., 2022). The traditional way of life as well as natural resources are certainly threatened, but it is necessary to take measures in order to place them in the right position of promotion on the tourist market, and to strengthen the entire economy of rural areas (Richards, 2015).

The aim of the research was to determine whether gastronomy affects the rural prosperity of rural settlements in Serbia. The data were collected through a random survey in 10 rural municipalities in Serbia, on a total sample of 524 respondents. The obtained data were processed in SPSS version 26.00 software. Descriptive statistical analysis revealed that the highest average rating of the quality of the tourist offer was given to issues related to the Environment and the region, while the item related to social media, which belongs to the Intermediaries factor, had the lowest rating. The results of a confirmed the first hypothesis H1 that the quality of the supply factor is at a satisfactory level, and also provided an answer to the research question R.Q.1 related to the quality of the service. Exactly six factors were obtained by exploratory factor analysis (EFA), where all issues related to the quality of the complete tourist offer

were grouped. After that, multiple regression analysis found that each of the factors has a significant impact on rural prosperity, thus confirming the hypotheses H2a - H2f, because it was shown that it is not only specific gastronomy that has an impact on rural development. Hypothesis H3 is partially confirmed. Research question R.Q.2 receives an affirmative answer that gastronomy affects rural prosperity. Analysis of variance showed that material status does not show a statistically significant difference in the perception of the impact of gastronomy on rural development (H4a negated), while age shows a statistically significant difference (H4b confirmed).

There were limiting circumstances during the investigation. During the field research, the poor cooperation of the local population with the researchers was revealed, on the one hand due to the unknown about the research and on the other hand due to the pandemic which is still present in people's consciousness. Also, limiting circumstances also concern theoretical aspects, because there is not much research on this topic. A lot is written about rural tourism, but there is not much research on the impact of gastronomy on rural development for the area of Serbia. Certainly, this research with its data will contribute to the development of the theory, but also the possible application of the data in some subsequent researches in the territory of Serbia. Also, the report from the field and the data can be used to assess the current state of rural development and devise a strategy for marketing rural areas and traditional gastronomy to the tourist market, which would have a positive impact on the economy of rural settlements, but also on greater employment and the return of youth to those regions.

Conflict of interests

The authors declare no conflict of interest.

References

1. Alonso, A. D., Bressan, A., & Sakellarios, N. (2017). Exploring innovation perceptions and practices among micro and small craft breweries: A three-country study. *International Journal of Wine Business Research,* 29 (2), 140–158.doi: 10.1108/IJWBR-03-2016-0011
2. Božović, T., Blešić, I., Nedeljković Knežević, M., Đeri, L., & Pivac, T. (2021). Resilience of tourism employees to changes caused by COVID-19 pandemic. *Journal of the Geographical Institute "Jovan Cvijić" SASA,* 71(2), 181–194. doi.org:10.2298/IJGI2102181B
3. Cohen, E., & Avieli, N. (2004). Food in Tourism, Attraction and Impediment. *Annals of Tourism Research*, 31(4), 755-778. doi:10.1016/j.annals.2004.02.003
4. Cvijanović, D., Gajić, T., & Vukolić, D. (2022). Stronger Involvment of Women in the Development of Serbian Rural Tourism. International Scientific Conference Sustainable Agriculture and Rural Development. *Thematic Proceeding*, Belgrade, Serbia, 223-234

5. Dougherty, M. L., & Green, G. P. (2011). Local food tourism networks and word of mouth. *Journal of Extension*, 49 (2), 1–8.

6. Blešić, I., Ivkov, M., Tepavčević, J., Popov Raljić, J., Petrović,M., Gajić, T., N. Tretiakova, T., Syromiatnikova, J., Demirović Bajrami, D., Aleksić, M.,Vujačić, D., Kričković, E., Radojković, M., Morar, C.M., & Tin Lukić (2022). Risky Travel? Subjective vs. Objective Perceived Risks in Travel Behaviour—Influence of Hydro-Meteorological Hazards in South-Eastern Europe on Serbian Tourists. *Atmosphere*, 13, 1671.doi: 10.3390/atmos13101671

7. Gajić, T., Raljić, J.P., Blešić, I., Aleksić, M., Petrović, M.D., Radovanovic, M.M., Vukovic, D.B., Sikimic, V., Pivac, T., Kostic, M., et al. (2022a). Factors That Influence Sustainable Selection and Reselection Intentions Regarding Soluble/ Instant Coffee—The Case of Serbian Consumers. *Sustainability,* 14, 10701. doi:10.3390/ su141710701

8. Gajić, T., Zrnić, M., Vujić, T., Vujić, M., & Stojanović, Đ. (2022b). Gastronomy Offer in a Function of Creation and Co-creation of a Recognized Hotel Brand -Illustrations from Hotel Crni Vrh. *Economics of Agriculture*, 69(3), 749-763. doi:10.5937/ekoPolj2203749G

9. Gajić, T., Petrović, M., Blešić, I., Vukolić, D., Milovanović, I., Radovanović, M., Vuković, D., Kostić, M., Vuksanović, N., & Malinović, S. (2022c). COVID-19 Certificate as a Cutting-Edge Issue in Changing the Perception of Restaurants' Visitors – Illustrations From Serbian Urban Centers. *Frontiers in Psychology*, 13:914484, 1-11.doi: 10.3389/fpsyg.2022.914484

10. Gajić, T., Penić, M., & Vukolić, D. (2022d). The impact of fear of COVID-19 infection on consumers' intention to visit restaurants. *Hotel and Tourism Management*, 2022, 10 (1), 67-78. doi:10.5937/menhottur2201067G

11. Gajić, A., Krunić, N., Protić, B. (2021). Classification of Rural Areas in Serbia: Framework and Implications for Spatial Planning. S*ustainability*, 13, 1596. doi:10.3390/su13041596

12. Guzeli, B. (2016). Gastronomy Tourism, Motivations and Destinations. Global Issues and Tends in Tourism. Publisher: St. Kliment Ohridski University Press

13. Hall, C.M. & Sharples, L. (2003). The consumption of experiences or the experiences of consumption? An introduction to the tourism of taste. C. Michael Hall, Liz Sharples,

14. Mitchell, R., Macionis, N., & Cambourne, B. (Ed.) Food Tourism: Around the World: Development, Management and Markets. Chapter 1, p.1-24, Butterworth Heinemann, Oxford.

15. Harrington, R. J., & Ottenbacher, M. C. (2010). Culinary Tourism - A Case Study of the Gastronomic Capital. *Journal of Culinary Science & Technology,* 8(1), 14-32.

16. Horng, J. S., Liu, C. H., Chou, H. Y., Tsai, C. Y. (2012). Understanding the Impact of Culinary Brand Equity and Destination Familiarity on Travel Intentions. *Tourism Management* 33, 815-824.doi: 10.1016/j.tourman.2011.09.004

17. Kiralova, A., & Hamarneh, I. (2017). Local gastronomy as a prerequisite of food tourism development in the Czech Republic. *Marketing and Management of Innovations*, (2), 15–25.doi:10.21272/mmi.2017.2-01

18. Kocaman, M., & Kocaman, E.M. (2014). The importance of cultural and gastronomic tourism in local economic development: Zile sample. *International Journal of Economics and Financial Issues*, 4 (4), 735-744

19. Lakićević, M., Pantović, D., & Fedajev, A. (2023). Investigating Factors of Customer Loyalty Formation for Wellness Spa. Management: *Journal Of Sustainable Business And Management Solutions In Emerging Economies*, . doi:10.7595/management.fon.2021.0031

20. Lee, A. H. J., Wall, G., Kovacs, J. F., & Kang, S. Y. (2016). Food clusters and creative tourism development: A conceptual framework. *Journal of Rural and Community Development*, 11 (2), 72–88.

21. Lin, Y. C., Pearson, T. E., & Cai, L. A. (2011). Food as a Form of Destination Identity: A Tourism Destination Brand Perspective. *Tourism and Hospitality Research*, 11(1), 30-48.doi: 10.1057/thr.2010.22

22. Mak, A. H., Lumbers, M., Eves, A., & Chang, R. C. (2012). Factors Influencing Tourist Food Consumption. *International Journal of Hospitality Management,* 31 (3), 928-936.doi:10.1016/j.ijhm.2011.10.012

23. McKercher, B., Okumuş, F., & Okumuş, B. (2008). Food Tourism as a Viable Market Segment: It's All How You Cook the Numbers!. *Journal of Travel & Tourism Marketing,* 25(2), 137-148.doi:10.1080/10548400802402404

24. Quan, S., & Wang, N. (2004). Towards A Structural Model of the Tourist Experience: An Illustration from Food Experiences in Tourism. *Tourism Management*, 25(3), 297-305. doi:10.1016/S0261-5177(03)00130-4

25. Prada-Trigo, J. (2017). Tourism, territory and cuisine: Food consideration and perceptions regarding origin and social changes: The case of Guinea pig. *Journal of Tourism and Cultural Change*, 6825,1–16.doi: 10.1080/14766825.2017.1344678

26. Richards, G. (2015). Evolving gastronomic experiences: From food to foodies to foodscapes. *Journal of Gastronomy and Tourism*, 1, 5-18.doi: 10.3727/216929715X14298190828796

27. Sedarati, P., Santos, S., & Pintassilgo, P. (2018). System dynamics in tourism planning and development. *Tourism Planning & Development,* 16(1), 1-27.doi: 10.1080/21568316.2018.1436586.

28. Silkes, C.A. (2012). Farmers' Markets: A Case for Culinary Tourism. *Journal of Culinary Science & Technology*, 10, 326-336.

29. Sims, R. (2009). Food, Place and Authenticity: Local Food and the Sustainable Tourism Experience. *Journal of Sustainable Tourism*, 17 (3), 321-336.doi: 10.1080/09669580802359293

30. Vukolić, D., Gajić, T., & Popović, A. (2022). The influence of the names of the dishes in the menu on the choice in Serbian restaurants. *BIZINFO, Journal of Economics, Management and Informatics*, Blace, 13(1), 25-32. doi:10.5937/bizinfo2201025V (M51).

31. Williams, H.A., Williams Jr, R.L., & Omar, M. (2014). Gastro-tourism as destination branding in emerging markets. *Int. J. Leisure and Tourism Marketing,* 4 (1), 1-18.doi: 10.1504/IJLTM.2014.059257

A FAHP AND VIKOR METHOD FOR EVALUATION OF THE FINANCIAL PERFORMANCE OF AGRICULTURE COMPANIES LISTED ON THE BELGRADE STOCK EXCHANGE

Milorad Kovjanić[1], Predrag Vukadinović[2], Snežana Knežević[3], Tijana Obradović [4], Aleksandra Mitrović [5], Aleksandar Grgur [6], Marko Milašinović [7]

**Corresponding author E-mail: snezana.knezevic@fon.bg.ac.rs*

ARTICLE INFO

Original Article

Received: *02 November 2022*

Accepted: *25 February 2023*

doi:10.59267/ekoPolj2301185K

UDC 519.8:658.14(497.11Belgrade)

Keywords:

financial performance, FAHP method, VIKOR method, agriculture, forestry, and fisheries, Belgrade Stock Exchange

JEL*: C10, M40, Q12*

ABSTRACT

Decision-making can be improved by using different models by financial statements users for different purposes. In this paper, the FAHP model was implemented for financial performance evaluation of companies operating within the A-agriculture, forestry and fisheries sectors on the Belgrade Stock Exchange. In addition, we used the VIKOR method, for ranking companies against the results achieved. With all the constrains shown, the research presented in this paper, raises questions for insight and future development, through the possibilities of ranking the financial performance of the company.

1 Milorad Kovjanić, Ph.D student, Singidunum University, Danijelova Street no. 32, 11000 Belgrade, Serbia, E-mail: kovjanicmilorad64@gmail.com, ORCID ID (https://orcid.org/0009-0006-5545-4730)

2 Predrag Vukadinović, Ph.D., Associate professor, Singidunum University, Danijelova Street no. 32, 11000 Belgrade, Serbia, E-mail: pvukadinovic@singidunum.ac.rs, ORCID ID (https://orcid.org/0000-0002-4859-7497)

3 Snežana Knežević, Ph.D., Associate Professor, University of Belgrade, Faculty of Organizational Sciences, Jove Ilića street no. 154, 11000 Belgrade, Serbia, E-mail: snezana.knezevic@fon.bg.ac.rs, ORCID ID (https://orcid.org/0000-0003-0176-6107)

4 Tijana Obradović, Ph.D., Associate Professor, University of Belgrade, Faculty of Organizational Sciences, Jove Ilića street no. 154, 11000 Belgrade, Serbia, E-mail: obradovic.tijana@fon.bg.ac.rs, ORCID ID (https://orcid.org/0000-0001-9613-318X)

5 Aleksandra Mitrović, Ph.D., Associate Professor, University of Kragujevac, Faculty of Hotel Management and Tourism, Vojvođanska no. 5a, 36210 Vrnjačka Banja, Serbia, E-mail: aleksandra.stankovic@kg.ac.rs, ORCID ID (https://orcid.org/0000-0002-8302-0853)

6 Aleksandar Grgur, M.Sc., National Center for Corporate Education, Murska no. 14, 11000 Belgrade, Serbia, E-mail: grguraleksandar2@gmail.com, ORCID ID (https://orcid.org/0000-0002-1538-7055)

7 Marko Milašinović, M.Sc., Teaching Assistant, University of Kragujevac, Faculty of Hotel Management and Tourism, Vojvođanska no. 5a, 36210 Vrnjačka Banja, Serbia, E-mail: marko.milasinovic@kg.ac.rs, ORCID ID (https://orcid.org/0000-0002-9346-9283)

Introduction

Agricultural activities are of great importance to any economy. Agricultural production systems are very complex. The argument for this claim lies in the fact that these systems are influenced by the interaction of social and environmental factors. Dimensioning these factors can often be difficult (Nkurunziza et al. (2020). Given the benefits it leads to, as well as the risks it faces, it is important to explore the efficiency of businesses in this area. In particular, it is significant to examine efficiency of publicly listed companies whose shares are traded on stock exchanges. In the case of the Republic of Serbia, this is the case of the A-agriculture, forestry and fisheries sectors and companies whose shares are listed on the Belgrade Stock Exchange. There are numerous internal and external factors that affect the work of these companies, and because of the importance of accounting information in agriculture for different, numerous users, the importance and needs of this research are perceived. In addition, the importance of applying different methods for evaluating financial performance in agriculture and thus further supporting decision-making is also emphasized. There is an obvious problem of obtaining reliable data, its comparison, which clearly imposes the need for new research and relevant conclusions in this area. Financially sustainable business is influenced by a number of very complex factors, both internal and external (Srebro et al., 2021).

A specific field of the very nature of agricultural production, and special treatment of financial statements from this industry, lead to increased interest in this field. According to Sun (2010) "the analytic hierarchy process (AHP) is a powerful method to solve complex decision problems based on an additive weighting process, in which several relevant attributes are represented through their relative importance". Therefore, it is of great importance to compare the financial performance of the companies quantitatively (Milojević et al., 2021; Farrokh et al. 2016; Filgueira-Vizoso et al., 2023), through the results of FAHP models. It is considered significant that parts of the paper provide certain guidelines for improvement where this is possible. The above is the basis for adequate use of financial statements, all in synergy with the FAHP model, which as a mathematical model enables evaluation of the financial performance of the company. Therefore, the aim of this research is to evaluate the financial performance of companies listed in the sector of A-agriculture, forestry and fisheries in the Republic of Serbia using the FAHP framework.

At the beginning of the work, a review of literature was presented, followed by research methodology and theoretical basis of FAHP models and VIKOR models, as well as a literature overview of these models. The following section presents the results and discussion on the research.

Literature Review

Much of the research uses the AHP method in the first phase, to address the priority weights of criteria used by FAHP (Meixner, 2009, Knežević et al., 2017), and in the second is specifically tailored to the objectives of the work in different fields of

observation. Various problems in agriculture were discussed using the AHP model (Bogdanović & Hadžić, 2019; Ali et al., 2021; Veisi et al., 2022). One of the papers describes in detail the potential of the AHP method in choosing the best alternative in the decision tree with multiple criteria (see Brožova, 2004; Kong et al., 2005), especially emphasizing the importance of both the AHP method and other mathematical methods for decision-making processes in agricultural practice. In the work of Lu et al. (2014), the AHP weighting method is applied for the purpose of evaluating financial data for the sector that includes agriculture, forestry, animal husbandry and fisheries. The model relies on the analysis of profitability, solvency, capacity (operating & developmental), and liquidity. In doing so, two methods were combined - the analytical hierarchical process and the variance weighting method. Table 1 illustrates a short literature review emphasizing the main theoretical contributions related to application of the FAHP/AHP methods in the agricultural area.

Table 1. Theoretic and empirical contributions on FAHP/AHP methods in the agricultural area

Author	Focus	Methodology
Tashaoy et al. (2019)	determining land suitability for a watershed	FAHP
Sicat at al. (2005)	determining land suitability classification	AHP
Demirel et al. (2012)	risk-based evaluation of agricultural strategies	FAHP & FANP
Alphonce, C. B. (1997)	identifying potential applications in agricultural decisions in developing countries	AHP
Aktun & Samut (2013)	evaluating agricultural performance of the provinces of country	FAHP & VIKOR
Yang et al. (2019)	optimization of the disassembly line balancing model for agricultural machinery	FAHP
Choi et al. (2013)	finding the best way of agricultural reservoir water resources assessment	FAHP
Toloi et al. (2022)	determination of factors that are relevant for decision-making on soybean production	AHP

Source: Author's systematization

The AHP method was also used to evaluate criteria when evaluating agro-industrial projects (Din & Yunusova, 2016) and when formulating public policies related to family farms (Petrini et al., 2016).

Methodology

Existing knowledge of the financial performance of agricultural enterprises in the Republic of Serbia demonstrates the sense of using the FAHP method.

The research in the paper was conducted on a sample of 18 joint-stock companies listed on the Belgrade Stock Exchange within Sector A-Agriculture, Forestry and Fisheries. These are companies that are registered with the Agency for Business Registers under the activity code 0111 - Cultivation of cereal (except rice), legumes and oilseeds and that had made financial statements publicly available as of April 1, 2022. Thus, the research included the following companies: Agrobačka a.d. Bačka Topola, Bačka a.d. Sivac,

Bajinovac a.d. Bajina Bašta, Borac a.d. Šurjan, PP Feketić a.d. Sombor, Hajdučica a.d. Hajdučica, Irmovo a.d. Kisač, Jadran a.d. Nova Gajdobra, Lučić Prigrevica a.d. Novi Sad, Mitrosrem a.d. , Sremska Mitrovica, Nova Peščara a.d. Deliblata, Omoljica a.d. Omoljica, PTK Panonija a.d. Panonija, PP Miletić a.d. Sombor, Sloga a.d. Banatski Karlovac, Sloga a.d. Kać, Stari Tamiš a.d. Pančevo and Vojvodina a.d. Sombor. For the purposes of the research, data from the individual financial reports of the aforementioned companies in the period from 2015 to 2020 were used.

FAHP

Van Laarhoven (1983) proposed a method of fuzzy judgment by comparison to the triangular fuzzy number. Chang (1996) proposed the principle for comparison between the elements of the fuzzy numbers (see Zhu et al., 1999), and published it later in 1996. This work is considered the first, ma0king Chang the inventor of the FAHP method. Decision-making using the Fuzzy AHP method enabled the development of different approaches, and one of them is a fuzzy expanded AHP method based on fuzzy triangle numbers (Chang, 1996). Like all methods, this one has critics, but even so, its widespread prevalence and application in different decision-making areas is noticeable.

$X = \{x_1, x_2, ..., x_n\}$ is a set of objects, and $G = \{g_1, g_2, ..., g_n\}$ is a set of goals. The extended analysis methodology Chang (1996) for each object taken provides an extended analysis of the goal g_i. Extended Analysis Values m for each object can be presented as follows:

$$M_{g_i}^1, M_{g_i}^2, ..., M_{g_i}^n, i = 1, 2, ..., n, \qquad (1)$$

where $M_{g_i}^j, (j = 1, 2, ..., m)$ are fuzzy triangular numbers. This is the analysis of the following steps:

Step 1: The values of fuzzy extensions for the *i*-th object in Expressions (2):

$$S_i = \sum_{j=1}^{m} M_{g_i}^j \otimes \left[\sum_{i=1}^{n} \sum_{j=1}^{m} M_{g_i}^j \right]^{-1} \qquad (2)$$

In order to obtain the expression $\left[\sum_{i=1}^{n} \sum_{j=1}^{m} M_{g_i}^j \right]^{-1}$, it is necessary to perform additional fuzzy operations with values of the extended analysis, which is represented by Expressions (3), (4):

$$\sum_{j=1}^{m} M_{g_i}^i = \left[\sum_{j=1}^{m} l_i, \sum_{j=1}^{m} m_i, \sum_{j=1}^{m} u_i \right] \qquad (3)$$

$$\sum_{i=1}^{n}\sum_{j=1}^{m} M_{g_i}^{j} = \left[\sum_{j=1}^{m} l_i, \sum_{j=1}^{m} m_i, \sum_{j=1}^{m} u_i\right] \quad (4)$$

In addition, to calculate the inverse vector using Expression (5):

$$\left[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{g_i}^{j}\right]^{-1} = \left(\frac{1}{\sum_{j=1}^{m} u_j}, \frac{1}{\sum_{j=1}^{m} m_j}, \frac{1}{\sum_{j=1}^{m} l_j}\right) \quad (5)$$

Step 2: The degree of possibility for $M_2 = (l_2, m_2, u_2)$ and $M_1 = (l_1, m_1, u_1)$ is defined by Expression (6):

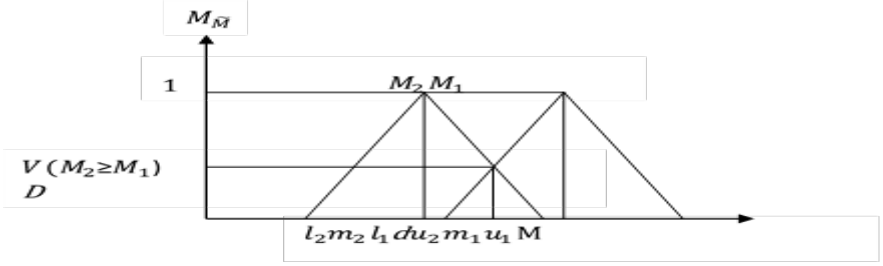
$$V(M_2 \geq M_1) = y \geq x\left[\min(\mu_{M_1}(x), \mu_{M_2}(y))\right] \quad (6)$$

It can be represented in the following manner by Expression (7):

$$V(M_1 \geq M_2) = hgt(M_1 \bigcap M_2) = \mu_{M_1}(d)$$
$$V(M_2 \geq M_1) = hgt(M_1 \bigcap M_2) = \mu_{M_2}(d) \quad (7)$$
$$= \begin{cases} 1 & m_2 \geq m_1 \\ 0 & l_1 \geq \mu_2 \\ \dfrac{l_1 - u_2}{(m_2 - m_1) - (m_1 - l_1)} & otherwise \end{cases}$$

Where d is the ordinate of the highest intersection point D between μ_{M_1} μ_{M1} and μ_{M_2} μ_{M2} (Figure 1). In order to compare M_1 and M_2, values of both $V(M_1 \geq M_2)$ $V(M1 \geq M2)$ and $V(M_2 \geq M_1)$ $V(M2 \geq M1)$ are needed.

Figure 1. The intersection between M_1 and M_2



Source: Chang (1996)

Step 3: The degree of possibility for a convex fuzzy number to be greater than the k k convex numbers $M_i (i = 1,2,...,k)$ can be defined by Expression (8):

$$\begin{aligned} &V(M \geq M_1, M_2, ..., M_k) \\ &V = V((M \geq M_1) and (M \geq M_2), ..., (M \geq M_k) \\ &V = \min V(M \geq M_i), i = 1,2,3,...,k \end{aligned} \quad (8)$$

Let us assume that Expression (9) is true:

$$d(A_i) = \min V(S_i \geq S_k) \quad (9)$$

for $k = 1,2,...,n; k \neq i$ $k = 1,2,...n;\ k \neq i$. The weight vector is obtained by Expression (10):

$$W' = (d'(A_1), d'(A_2, ..., d'(A_n))^T \quad (10)$$

Where $A_i (i = 1,2,...,n)$ consists of *n* elements.

Step 4: Through normalization, the weight vectors are reduced to Expression (11):

$$W = (d(A_1), d(A_2, ..., d(A_n))^T \quad (11)$$

where W does not represent a fuzzy number.

In order to address the main deficiency of the classic AHP method, which is an insufficiently large scale of comparison, different comparison scales have been developed based on fuzzy triangle numbers. One of them, through which it is easier to evaluate the importance of criteria or alternatives, is *Chang scale (*Chang, 1996). Assessing the significance between pairs means that after ranking all correlation coefficients within the indicators, weight coefficients are determined (see Knežević et al., 2019; Mitrović et al., 2015; Mitrović et al., 2021)

VIKOR METHOD

The VIKOR method ("VlseKriterijumska Optimizacija I Kompromisno Resenje") is recognizable by its frequent use in multi-criteria ranking and its usefulness when it comes to finding solutions for various variants of decision-making problems (Rajković et al., 2020). The application of the VIKOR method for multi-criteria ranking is based on the Q_i metric presented as follows*:*

$$Q = \frac{s_j - s^*}{s^- - s^*}, R = \frac{R_j - R^*}{R^- - R^*}, Q_i = v^* \frac{s_j - s^*}{s^- - s^*} + (1 - v)^* \frac{R_j - R^*}{R^- - R^*}, i = 1,2,m. \quad (12)$$

Otherwise, this method is distance-measure-based. The closest solution to an ideal is called a compromise solution or a viable solution. Further, according to the formula:

$$L_p(F^*,F)=\left\{\sum_{j=1}^{n}\left[f_j^*-f_j(x)^p\right]\right\}^{\frac{1}{p}},1\le p\le\alpha \qquad (13)$$

is pointed to the distance between ideal point F^* $F^*$the point *f*(*x*), in the criterion function space (Opricović, 1986).

First of all, it is pointed out that for each action there is a value of Qi, in order to determine afterwards which action is characterized by the smallest value, because that action is chosen. The next step is to calculate the measure for the multicriteria ranking of the i-th action (Qi) as follows:

$$Q=p^*QS_i+(1-p)^*QR_i \qquad (14)$$

where

$$Q=\frac{s_j-s^*}{s^-s^*},R=\frac{R_j-R^*}{R^--R^*} \qquad (15)$$

Minimizing the mentioned metric leads to finding a compromise solution. By applying the FAHP method, the weighting coefficients for the observed financial ratio (which represent the technique of financial analysis) in the financial performance segment (Mandić et al., 2014) are identified, so that in the next step, the VIKOR method is applied. The purpose of the VIKOR method is to evaluate companies using four rating criteria, with the ultimate goal of determining which company has the best financial performance. It is especially emphasized that the VIKOR method has a high utility value when it comes to decision-making problems related to conflicted and incommensurable criteria or when quantitative or qualitative criteria are considered (Muñoz-Medina et al., 2021).

Results and Discussion

At the beginning of presenting the results of the research, the weight coefficients are shown according to the types of financial ratios (Knežević et al., 2019), specifically for each of them (Table 2).

Table 2. Weight coefficients by types of ratio indicators.

Type of ratio	Name	Weight coefficient
Liquidity ratios	Cash-coverage ratio	0.496
	Acid test ratio	0.292
	Working capital ratio	0.118
	Net working capital	0.094

Type of ratio	Name	Weight coefficient
Profitability ratios	ROA	0.441
	ROE	0.280
	Profit margin ratio	0.112
	Operating margin ratio	0.168
Solvency ratios	Debt-to-Equity ratio	0.541
	Interest coverage ratio	0.224
	Debt ratio	0.131
	Equity ratio	0.104
Activity ratios	Collection period	0.339
	Days' sales in cash	0.409
	Days payable outstanding	0.126
	Total asset turnover	0.125

Source: Author's analysis

The next step determines the values of liquidity, profitability, solvency and activities ratios from 2015-2020, and according to the years of observed companies. Some of the companies in the particular year and particular indicators could not be ranked because they did not have a profit at the end of the year, or had no debts, so certain ratios could not be calculated. After receiving value results for all indicators for all 6 years, it was necessary to determine the rankings of companies for each specific indicator. Table 3 shows the rankings of companies by liquidity ratios.

Table 3. Company rankings according to liquidity indicator.

Company name	2015	2016	2017	2018	2019	2020
Agrobačka a.d. Bačka Topola	2	3	2	2	1	1
Jadran a.d. Nova Gajdobra	1	1	1	1	2	2
Omoljica a.d. Omoljica	14	14	13	14	5	3
Lučić Prigrevica a.d. Novi Sad	6	6	4	4	4	4
Mitrosrem a.d. Sremska Mitrovica	17	17	5	10	6	5
Sloga a.d. Kać	3	2	3	3	3	6
Stari Tamiš a.d. Pančevo	8	7	7	7	8	7
Borac a.d. Šurjan	9	10	11	9	10	8
PTK Panonija a.d. Panonija	11	11	10	8	13	9
Vojvodina a.d. Sombor	7	8	8	6	11	10
PP Miletić a.d. Sombor	10	9	9	5	12	11
Hajdučica a.d. Hajdučica	13	13	15	15	7	12
Nova Peščara a.d. Deliblato	5	5	12	11	14	13
PP Feketić a.d. Sombor	12	12	14	13	15	14
Irmovo a.d. Kisač	15	15	16	16	16	15
Bačka a.d. Sivac	18	18	6	12	9	16
Bajinovac a.d. Bajina Bašta	16	16	17	17	17	17
Sloga a.d. Banatski Karlovac	4	4	18	18	18	18

Source: Author's analysis

In the listed liquidity indicator table, the company Jadran a.d. Nova Gajdobra has the best rankings in all 6 years observed. In the following table there is a ranking of observed companies for profitability indicators.

Table 4. Company rankings according to profitability indicator.

Company name	2015	2016	2017	2018	2019	2020
Agrobačka a.d. Bačka Topola	17	15	17	17	17	16
Jadran a.d. Nova Gajdobra	16	16	16	15	16	17
Lučić Prigrevica a.d. Novi Sad	1	6	2	3	4	9
Mitrosrem a.d. Sremska Mitrovica	12	7	9	13	9	3
Sloga a.d. Kać	3	13	14	12	15	15
Stari Tamiš a.d. Pančevo	9	5	3	4	6	5
Borac a.d. Šurjan	11	1	7	5	2	4
PTK Panonija a.d. Panonija	7	10	8	10	3	1
Vojvodina a.d. Sombor	6	9	6	6	10	11
PP Miletić a.d. Sombor	4	3	1	2	11	10
Hajdučica a.d. Hajdučica	10	8	5	7	12	2
Nova Peščara a.d. Deliblato	14	11	10	9	8	12
PP Feketić a.d. Sombor	5	2	4	8	7	8
Irmovo a.d. Kisač	2	4	13	1	1	7
Bačka a.d. Sivac	15	14	11	11	14	14
Sloga a.d. Banatski Karlovac	8	17	15	16	5	6
Omoljica a.d. Omoljica	/	12	/	14	13	13
Bajinovac a.d. Bajina Bašta	/	/	/	0	0	0

Source: Author's analysis

Lucic Prigrevica a.d. Novi Sad has the best rankings in the table for the profitability indicator. Omoljica a.d. Omoljica and Bajinovac a.d. Bajina Bašta companies cannot be taken into account, because during some years they did not have sales revenues. Table 5 shows ranking of observed companies for activity indicators.

Table 5. Company rankings according to activity indicator.

Company name	2015	2016	2017	2018	2019	2020
Agrobačka a.d. Bačka Topola	16	16	15	15	15	14
Jadran a.d. Nova Gajdobra	15	14	16	16	16	15
Lučić Prigrevica a.d. Novi Sad	11	9	10	10	8	10
Mitrosrem a.d. Sremska Mitrovica	2	6	9	11	10	6
Sloga a.d. Kać	12	15	14	14	14	12
Stari Tamiš a.d. Pančevo	13	13	13	13	13	1
Borac a.d. Šurjan	9	4	5	5	4	8
PTK Panonija a.d. Panonija	10	10	8	9	9	7
Vojvodina a.d. Sombor	6	5	4	4	3	5
PP Miletić a.d. Sombor	4	7	6	7	6	4
Hajdučica a.d. Hajdučica	7	11	12	8	11	2
Nova Peščara a.d. Deliblato	14	12	11	12	12	13
PP Feketić a.d. Sombor	3	1	2	2	1	3
Irmovo a.d. Kisač	5	2	1	1	2	9
Bačka a.d. Sivac	8	8	7	6	7	11
Sloga a.d. Banatski Karlovac	1	3	3	3	5	16
Omoljica a.d. Omoljica	/	17	/	16	16	16
Bajinovac a.d. Bajina Bašta	/	/	/	16	16	16

Source: Author's analysis

Table 5 shows that PP Feketić a.d. Sombor has the best rankings for activity indicators. Omoljica a.d. Omoljica and Bajinovac a.d. Bajina Bašta companies cannot be taken into account, because during some years they did not have specific parameters for calculating activity ratios. Table 6 shows the company's solvency indicator rankings.

Table 6. Company rankings according to solvency indicator.

Company name	2015	2016	2017	2018	2019	2020
Agrobačka a.d. Bačka Topola	16	15	14	16	16	17
Jadran a.d. Nova Gajdobra	7	7	8	4	4	8
Lučić Prigrevica a.d. Novi Sad	1	2	6	7	8	7
Mitrosrem a.d. Sremska Mitrovica	11	10	9	9	10	12
Sloga a.d. Kać	10	8	7	8	9	10
Stari Tamiš a.d. Pančevo	3	3	1	1	1	3
Borac a.d. Šurjan	6	5	4	3	5	4
PTK Panonija a.d. Panonija	4	4	2	2	2	2
Vojvodina a.d. Sombor	15	14	16	15	14	15
PP Miletić a.d. Sombor	5	1	12	13	13	13
Hajdučica a.d. Hajdučica	2	13	15	11	3	1
Nova Peščara a.d. Deliblato	13	11	11	12	11	11
PP Feketić a.d. Sombor	8	9	13	14	14	14
Irmovo a.d. Kisač	12	12	10	10	12	9
Bačka a.d. Sivac	14	16	17	17	17	16
Sloga a.d. Banatski Karlovac	9	6	3	6	6	5
Omoljica a.d. Omoljica	/	0	/	5	7	6
Bajinovac a.d. Bajina Bašta	/	/	/	0	0	0

Source: Author's analysis

In Table 6 for the solvency indicator, Stari Tamiš a.d. Pančevo has the best ranking. Omoljica a.d. Omoljica and Bajinovac a.d. Bajina Bašta companies cannot be taken into account, because for some years they did not have specific parameters for calculating solvency ratios. The AHP method can be combined with the VIKOR method when we want to adapt AHP method to changes in the environment. The ratio numbers used in the AHP method are used to determine the significance of certain ratio numbers within a specific indicator. After the significance of ratio numbers and indicators have been obtained by using the AHP method, the VIKOR method is used to rank companies against the achieved results. As the significance of the indicator differs according to the user of the financial statements' information, this research uses the creditor's perspective. In this sense, the significance of the indicators can be seen in the following table.

Table 7. Significance of indicators.

Significance of indicators	Indicator
0.427	Liquidity
0.326	Profitability
0.156	Solvency
0.093	Activity

Source: Author's analysis

In the end, we get the following table that shows us, according to the values of the indicators, which companies have the highest rankings in relation to each other.

Table 8**.** Company rankings.

Company name	2015	2016	2017	2018	2019	2020
Stari Tamiš a.d. Pančevo	6	4	3	4	3	1
Mitrosrem a.d. Sremska Mitrovica	17	16	5	12	4	2
PTK Panonija a.d. Panonija	10	12	6	6	5	3
Hajdučica a.d. Hajdučica	14	15	16	15	6	4
Borac a.d. Šurjan	8	3	7	5	2	5
PP Miletić a.d. Sombor	4	2	2	2	15	6
Vojvodina a.d. Sombor	5	6	4	3	8	7
Lučić Prigrevica a.d. Novi Sad	2	1	1	1	1	8
PP Feketić a.d. Sombor	7	5	9	9	13	9
Irmovo a.d. Kisač	13	13	17	10	7	10
Sloga a.d. Kać	1	7	10	7	11	11
Agrobačka a.d. Bačka Topola	16	14	13	13	12	12
Jadran a.d. Nova Gajdobra	11	10	12	8	10	13
Omoljica a.d. Omoljica	15	17	14	17	9	14
Nova Peščara a.d. Deliblato	12	8	15	11	18	15
Bačka a.d. Sivac	18	18	8	16	16	16
Bajinovac a.d. Bajina Bašta	9	9	11	14	14	17
Sloga a.d. Banatski Karlovac	3	11	18	18	17	18

Source: Author's analysis

According to the analysis shown in the paper, and to the data from the financial statements, in years 2015-2020, the best companies were Stari Tamiš a.d. Pančevo, PP Miletić a.d. Sombor and Lučić Prigrevica a.d. Novi Sad.

Conclusions

Different models are used for decision-making, and their application is usually limited by the display of information in financial statements. The FAHP and VIKOR methods help users to make a decision and can be very useful for ranking and evaluating companies on that basis. The aim of this paper was to explore and rank the financial performance of companies operating within the A-agriculture, forestry and fisheries sector on the Belgrade Stock Exchange, using FAHP and VIKOR methods.

In today's turbulent and competitive environment, a company's performance evaluation and its comparison with other companies is an important issue for various interest groups and for various reasons. It is about reaching the various investment goals of investors and creditors, with a focus on long-term sustainable business.

The research and analyses presented in this work contribute to the expansion of existing literature for a number of reasons. The ranking of companies operating within the A-agriculture, forestry and fisheries sector listed on the Belgrade Stock Exchange

is presented and analysed, which can be used for further analysis of companies listed on this stock exchange, as well as for analysis of the entire Sector A. The results of the survey outspread previous research in this field. In addition, the work and research done in this paper have certain limitations, which also represent the possibilities of further research. Namely, the research was limited to one sector observed, in this case agriculture, forestry and fisheries, which can be extended to more or even all companies whose shares are listed on the Belgrade Stock Exchange. Likewise, the sample can be extended to all companies from sector A in the Republic of Serbia. Finally, further research may include more spatial and time-consuming samples.

Conflict of interests

The authors declare no conflict of interest.

References

1. Aktan, E., Samut, P. K. (2013). Agricultural performance evaluation by integrating fuzzy AHP and VIKOR methods, *International Journal of Applied Decision Sciences, 6*(4), 324-344, https://doi.org/10.1504/IJADS.2013.056865
2. Ali, E. B., Agyekum, E. B., & Adadi, P. (2021). Agriculture for sustainable development: A SWOT-AHP assessment of Ghana's planting for food and jobs initiative. *Sustainability*, *13*(2), 628. https://doi.org/10.3390/su13020628
3. Alphonce, C. B. (1997). Application of the analytic hierarchy process in agriculture in developing countries, *Agricultural Systems. 53*, 1, 97-112
4. Bogdanović, S., & Hadžić, M. (2019). Strategic multicriteria decision-making process in agriculture. *Economic of Agriculture, 66*(1), 89-106. https://doi.org/10.5937/ekoPolj1901089B
5. Brožová, H. (2004). The analytic hierarchy process for the decision tree with multiple criteria. *Agricultural Economics*, *50*(2), 77-82. http://dx.doi.org/10.17221/5170-AGRICECON
6. Chang, D. Y. (1996). Applications of the extent analysis method on fuzzy AHP. European journal of operational research, 95(3), 649-655.
7. Choi, Eun-Hyeok, Bae, Sang Soo, & Jee, Hong Kee. (2013). Prioritization for Water Storage Increase of Agricultural Reservoir using FAHP Method. *Journal of Korea Water Resources Association, 46* (2), 171–182, https://doi.org/10.3741/JKWRA.2013.46.2.171
8. Demirel, N. Ç., Yücenur, G. N., Demirel, T., & Muşdal, H. (2012). Risk-Based Evaluation of Turkish Agricultural Strategies using Fuzzy AHP and Fuzzy ANP. *Human and Ecological Risk Assessment: An International Journal, 18*(3), 685–702. doi:10.1080/10807039.2012.672902

9. Din, G. Y., & Yunusova, A. B. (2016). Using AHP for evaluation of criteria for agro-industrial projects. *International Journal of Horticulture and Agriculture*, *1*(1), 6. http://dx.doi.org/10.15226/2572-3154/1/1/00104

10. Farrokh, M., Heydari, H., & Janani, H. (2016). Two comparative MCDM approaches for evaluating the financial performance of Iranian basic metals companies. *Iranian Journal of Management Studies*, 9, 359–382.

11. Filgueira-Vizoso, A., Cordal-Iglesias, D., Puime-Guillén, F., Lamas-Galdo, I., Martínez-Rubio, A., Larrinaga-Calderón, I., & Castro-Santos, L. (2023). Sensitivity study of the economics of a floating offshore wind farm. The case study of the SATH® concrete platform in the Atlantic waters of Europe. *Energy Reports*, 9, 2604-2617.

12. Knežević, S. P., Mandić, K., Mitrović, A., Dmitrović, V., & Delibašić, B. (2017). An FAHP-TOPSIS framework for analysis of the employee productivity in the Serbian electrical power companies. *Management: Journal of Sustainable Business and Management Solutions in Emerging Economies*, *22*(2), 47-60.

13. Knežević, S., Mitrović, A., Vujić, M. & Grgur, A. (2019). *Analiza finansijskih izveštaja.* Samostalno izdanje autora, Beograd. [*in English*: Knežević, S., Mitrović, A., Vujić, M. & Grgur, A. (2019). *Financial statement analysis.* Self-published by the author, Belgrade]

14. Kong, F., & Liu, H. (2005). Applying fuzzy analytic hierarchy process to evaluate success factors of e-commerce. *International Journal of Information and Systems Sciences*, *1*(3-4), 406-412.

15. Lin, C. N. (2020). A fuzzy analytic hierarchy process-based analysis of the dynamic sustainable management index in leisure agriculture. *Sustainability*, *12*(13), 5395. https://doi.org/10.3390/su12135395

16. Lu, H., Cheng, Y., Gao, H., Zhou, C., & Wang, Q. (2014). Evaluation of Growth of Agricultural Listed Companies Based on AHP Weighting Method. *Asian Agricultural Research*, *6*(12), 23-25.

17. Mandić, K., Delibašić, B., Knežević, S., & Benković, S. (2014). Analysis of the financial parameters of Serbian banks through the application of the fuzzy AHP and TOPSIS methods. *Economic Modelling*, *43*, 30-37. https://doi.org/10.1016/j.econmod.2014.07.036

18. Meixner, O. (2009). Fuzzy AHP group decision analysis and its application for the evaluation of energy sources. In *Proceedings of the 10th International Symposium on the Analytic Hierarchy/Network Process* (pp. 2-16), Pittsburgh, PA, USA

19. Milojević, S., Adamović, M., Grgur, A. (2021). Evaluation of the Financial Performance of Serbian Dairy Companies Using the Integrated AHP and VIKOR Methodology for Sustainable Competition. *International Academic Journal, 2*(2), 50-67.

20. Mitrović, A., Knežević, S., & Milašinović, M. (2021). Profitability analysis of hotel companies in the Republic of Serbia. *Hotel and Tourism Management, 9*(1), 121-134. https://doi.org/10.5937/menhottur2101121M

21. Mitrović, A., Knežević, S., & Veličković, M. (2015). Ratio analysis specifics of the family dairies financial statements. *Economics of Agriculture, 62*(4), 1061-1078. https://doi.org/10.5937/ekoPolj1504061M

22. Muñoz-Medina, B., Ordóñez, J., Romana, M., & Lara-Galera, A. (2021). Typology Selection of Retaining Walls Based on Multicriteria Decision-Making Methods. *Appl. Sci.*, *11*(4), 1457. https://doi.org/10.3390/app11041457

23. Nkurunziza, L., Watson, C. A., Öborn, I., Smith, H. G., Bergkvist, G., Bengtsson, J. (2020). Socio-ecological factors determine crop performance in agricultural systems, *Scientific Reports, 10,* 4232. https://doi.org/10.1038/s41598-020-60927-1

24. Opricović, S. (1986). *Multicriteria Optimization.* Naučna Knjiga, Belgrade.

25. Petrini, M. A., Rocha, J. V., Brown, J. C., & Bispo, R. C. (2016). Using an analytic hierarchy process approach to prioritize public policies addressing family farming in Brazil. *Land Use Policy*, *51*, 85-94. https://doi.org/10.1016/j.landusepol.2015.10.029

26. Rajković, J., Poštin, J., Konjikušić, M., Jagodić-Rusić, A., & Nikolić, M. (2020). Multi-criteria ranking of available forms of promotional activities: A case analysis. *Anali Ekonomskog Fakulteta u Subotici, 56*(43)*,* 153–169. https://doi.org/10.5937/AnEkSub2001153R

27. Sicat, R. S., Carranza, E. J. M., Nidumolu, U. B. (2005). Fuzzy modeling of farmers' knowledge for land suitability classification. *Agricultural Systems*, *83*, 49–75.

28. Srebro, B., Mavrenski, B., Bogojević Arsić, V., Knežević, S., Milašinović, M., & Travica, J. (2021). Bankruptcy Risk Prediction in Ensuring the Sustainable Operation of Agriculture Companies. *Sustainability, 13*(14): 7712. https://doi.org/10.3390/su13147712.

29. Sun, C.-C. (2010). A performance evaluation model by integrating fuzzy AHP and fuzzy TOPSIS methods. *Expert Systems with Applications, 37*(12), 7745–7754. doi:10.1016/j.eswa.2010.04.066

30. Tashayo, B., Honarbakhsh, A., Azma, A., Akbari, M., (2020). Combined Fuzzy AHP–GIS for Agricultural Land Suitability Modeling for a Watershed in Southern Iran. *Environmental Management, 66,* 364–376, https://doi.org/10.1007/s00267-020-01310-8

31. Toloi, R. C., Reis, J. G. M. D., Toloi, M. N. V., Vendrametto, O., & Cabral, J. A. S. P. (2022). Applying analytic hierarchy process (AHP) to identify decision-making in soybean supply chains: a case of Mato Grosso production. *Revista de Economia e Sociologia Rural*, *60*(2), https://doi.org/10.1590/1806-9479.2021.229595

32. Van Laarhoven, V., & Pedrycz, W. (1983). A fuzzy extention of saaty′ s priority theory.fuzzy sets and systems. *Fuzzy Sets and Systems*, *11*(1-3), 229-241. https://doi.org/10.1016/S0165-0114(83)80082-7

33. Veisi, H., Deihimfard, R., Shahmohammadi, A., & Hydarzadeh, Y. (2022). Application of the analytic hierarchy process (AHP) in a multi-criteria selection of agricultural irrigation systems. *Agricultural Water Management*, *267*, 107619. https://doi.org/10.1016/j.agwat.2022.107619

34. Wang, Y. J. (2008). Applying FMCDM to evaluate financial performance of domestic airlines in Taiwan. *Expert Systems with Applications*, *34*(3), 1837-1845. https://doi.org/10.1016/j.eswa.2007.02.029

35. Yang, Y., Yuan, G., Zhuang, Q., & Tian, G. (2019). Multi-objective low-carbon disassembly line balancing for agricultural machinery using MDFOA and Fuzzy AHP. *Journal of Cleaner Production.* doi: 10.1016/j.jclepro.2019.06.035

36. Zhu, K. J., Jing, Y., & Chang, D. Y. (1999). A discussion on extent analysis method and applications of fuzzy AHP. *European journal of operational research*, *116*(2), 450-456. https://doi.org/10.1016/S0377-2217(98)00331-2

THE INFLUENCE OF CALCIFICATION AND NPK FERTILIZERS ON THE ECONOMICS OF TRITICALE PRODUCTION

Violeta Babić[1], Vera Rajičić[2], Dragan Terzić[3], Marijana Dugalić [4], Nenad Đurić [5], Marija Vučić [6]

**Corresponding author E-mail: babic.violeta@ni.ac.rs*

ARTICLE INFO

Original Article

Received: *13 December 2022*

Accepted: *25 February 2023*

doi:10.59267/ekoPolj2301201B

UDC 633.11:631.82.033

Keywords:

fertilization; economy; yield; productivity; profitability; triticale

***JEL**: Q180*

ABSTRACT

The tests were performed on the property of the Agricultural and Chemical School "Doctor Djordje Radic" in Kraljevo, on pseudogley soil, during a two-year period (2015/16 and 2016/17). Based on the analysis of production value and total variable costs, a production calculation was made. Elements of economic efficiency (productivity, economy and profitability) were calculated for all four variants of fertilization. The tests showed a significant variation in grain yield in the tested fertilization variants. During the two-year research, the T2 variant fertilized with mineral nutrients with increased phosphorus dose (NP2K) had the most favorable values of economic efficiency indicators. Variant T2 can be considered the most profitable and most cost-effective, regardless of the fact that the yield and production value were the highest in variant T4, which is fertilized with a combination of mineral nutrients with increased doses of phosphorus, lime and organic fertilizers.

1 Violeta Babić, Ph.D, Assistant Professor, University of Niš, Faculty of Agriculture, Kosančićeva 4, 37000 Kruševac, Serbia. Phone: +381 60 645 45 45, E-mail: babic.violeta@ni.ac.rs, ORCID ID (https://orcid.org/0000-0001-9536-973X)

2 Vera Rajičić, Ph.D, Assistant Professor, Principal Research Fellow, University of Niš, Faculty of Agriculture, Kosančićeva 4, 37000 Kruševac, Serbia. Phone: +381 65 229 32 55, E-mail: verarajicic74@gmail.com, ORCID ID (https://orcid.org/0000-0002-4468-7073)

3 Dragan Terzić, Ph.D, Assistant Professor, Senior Research Associate, University of Niš, Faculty of Agriculture, Kosančićeva 4, 37000 Kruševac, Serbia. Phone: +381 63 309 854, E-mail: dragan.terzic.agro@gmail.com, ORCID ID (https://orcid.org/0000-0002-0109-7460)

4 Marijana Dugalić, Teaching, Assistant, University of Niš, Faculty of Agriculture, Kosančićeva 4, 37000 Kruševac, Serbia. Phone: +381 69 604 307, E-mail: marijanadugalic80@gmail.com, ORCID ID (https://orcid.org/0000-0003-1170-0292)

5 Nenad Đurić, Ph.D, Senior Research Fellow, Associate Professor, Institute for vegetable crops, Karađorđeva 71, 11420 Smederevska Palanka, Serbia. Phone: +381 62 803 53 60, E-mail: nenad.djuric@outlook.com, ORCID ID (https://orcid.org/0000-0001-5048-454X)

6 Marija Vučić, English teacher, University „Union - Nikola Tesla", Beglrade, Faculty of Business Studies and Law, Jurija Gagarina 149a, 11000 Belgrade, Serbia. Phone:+381 631822 922, E-mail: marija.kezic@fpsp.edu.rs, ORCID ID (https://orcid.org/0000-0003-2854-2648)

Introduction

Triticale is a hybrid plant species that was developed by humans that tends to combine the advantageous traits of both wheat and rye. Triticale's capacity to absorb nutrients during the growth season is influenced by the height of the yield and the size of the vegetative organs. The most typical nitrogen applications in Serbia vary from 80 to 120 kg ha^{-1}, depending on the agrochemical characteristics of the soil (Đekić et al., 2014; Terzic et al., 2018; Rajičić et al., 2020a). Large volumes of fertilizers can reduce yields and be detrimental to the environment and the economy, which is a major cause of agroecosystem pollution (Đekić et al., 2016; Rajičić et al., 2019; Madić et al., 2020; Tmušić et al., 2021). Weather and particular site conditions have a big impact on how well fertilizers are used and how much produce is produced (Đekić et al., 2014; Đurić et al., 2016; Madić et al., 2018; Terzić et al., 2018; Rajičić et al., 2021). Effective nitrogen fertilization is essential for producing grains profitably, as well as safeguarding groundwater and surface waters from contamination brought on by nitrate leaching as a result of excessive and insufficient nitrogen application (Todorović and Filipović, 2009; Biberdžić et al., 2012; Babić et al., 2021). Triticale has fewer agro-technical investment requirements than other small grains and is more suited to unfavorable soil and environmental circumstances, which has led to an increase in its use in organic and sustainable agricultural production (Đurić et al., 2015; Rajičić et al., 2020a; Babić et al., 2021). When mineral fertilizers are applied to acidic soils in conjunction with lime and manure, the acidity of the soil is reduced, increasing the yield of farmed crops (Đurić et al., 2015; Rajičić et al., 2020b; Babić et al., 2021). Due to the higher cost of mineral, lime, and organic fertilizers as well as the higher cost of producing cereals on acidic soils, it is debatable if such practices are profitable. The examination of variable production costs can serve as a foundation for economic analysis in order to produce grains more efficiently and with the highest quality at the lowest possible cost (Vukoje et al., 2011; Biberdžić et al., 2012). Examining the triticale yield and the financial justification for using various fertilizer types and doses during the two growing seasons in the production of triticale on acidic soil were the main objectives of this study.

Material and methods

Experimental design

The tests were conducted over a two-year period (2015/16 and 2016/17) on the premises of the Agricultural-Chemical School "Dr Djordje Radic" in Kraljevo on pseudogley soil. Micro tests were performed on the winter triticale variety Trijumf, which was created at the Center for Small Grains in Kragujevac. The trials were set up using a randomized block system with five repetitions and a plot size of 5 x 10 m^2. The experiment included control (C) and four treatments of fertilizers and their combinations (T1-120 kg ha^{-1} N, 80 kg ha^{-1} P_2O_5 and 60 kg ha^{-1} K_2O; T2-120 kg ha^{-1} N, 100 kg ha^{-1} P_2O_5 and 60 kg ha^{-1} K_2O, T3-120 kg ha^{-1} N, 80 kg ha^{-1} P_2O_5 and 60 kg ha^{-1} K_2O and 5 t ha^{-1} lime and 20 t ha^{-1} manure and T4-120 kg ha^{-1} N, 100 kg ha^{-1} P_2O_5 and 60 kg ha^{-1} K_2O and 5 t ha^{-1} lime and 20 t ha^{-1} manure). According to the predetermined timetable, fertilization is carried

out on a regular basis each year using the specified amounts of nutrients. Half of the nitrogen fertilizer, together with the total amount of phosphorus, potassium, lime, and manure fertilizers, is applied before sowing, and the remaining half is added all at once during the full-rooting phase, either at the end of winter or the start of spring. The second decade of October saw the completion of sowing. Standard maintenance practices were used throughout the vegetative season. After the triticale reached full maturity, it was harvested. During this time, the yield was assessed and the moisture content was corrected to 14%.

Soil analysis

The soil on which the experiment was placed belongs to the type of pseudogley soil, heavy mechanical composition and rough unstable structure. Soil fertility is moderate, low pH values (pH in H_2O = 5.24 in KCl<4.48), with a humus content of about 2.18% and a total nitrogen content of 0.10 to 0.14%. The easily accessible phosphorus content was low (7-8 mg 100 g^{-1} of P_2O_5 soil), while the easily accessible potassium content was moderate (13.8 mg of 100 g^{-1} K_2O soil).

Statistical analysis

Based on the achieved research results, the parameters of descriptive statistics were calculated: average values and standard deviation. Statistical data processing was performed in the Analyst module of the SAS/STAT program (SAS Institut, 2000).

Indicators of economic efficiency of triticale production

Based on the analysis of the value of triticale production and total variable costs, the calculation of production and elements of economic efficiency (productivity, economy and profitability) for all four variants of fertilization was done. Coverage of variable costs of triticale production per hectare was calculated based on the following formula:

CVC = Q - VC, when Q = (q • c)

CVC - coverage of variable costs

Q- value of production

VC- variable costs

q- quantity of product

c- price of the product per unit of measure

A calculation of triticale production was made on the basis of variable costs for all four variants of fertilization. Based on the obtained data, a comparison of triticale production was made between different fertilization variants.

Meteorological conditions

The research was conducted during two consecutive seasons (2015/16 and 2016/17) in the Raska district, Central Serbia, on the type of pseudogley soil, in the secondary agricultural school "Doctor Djordje Radic", in Kraljevo (43° 43′00′′N, 20° 40′60′′E). The study area is Kraljevo, located at an altitude of about 192-217 m in the zone of temperate continental climate, with an average annual temperature of 11.5°C and the amount of precipitation of about 580-790 mm.

Table 1. Mean monthly air temperatures and precipitation in Kraljevo, Serbia (2015-2017), in relation to many years average (1980-2010)

Interval	X	XI	XII	I	II	III	IV	V	VI	Average
Mean monthly air temperature (°C)										
2015/16	11.6	7.3	2.3	-0.1	8.8	7.8	14.1	15.5	21.3	9.84
2016/17	10.6	6.8	0.0	-5.0	4.5	10.3	11.3	16.2	24.2	8.77
Average	11.8	6.0	1.9	0.3	2.3	6.8	11.8	16.7	19.8	8.60
The amount of precipitation (mm)										
2015/16	56.8	64.0	9.0	86.2	52.7	157.9	39.9	135.9	48.6	651.0
2016/17	84.1	77.6	9.4	27.1	35.3	57.7	82.1	99.9	56.2	529.4
Average	57.3	56.6	56.1	45.1	45.4	52.9	62.6	71.2	92.2	539.4

Source: https://www.hidmet.gov.rs/ciril/meteorologija/agrometeorologija.php

The data shown in Table 1 for the studied vegetation period (2015-2017) clearly indicate that the years in which the tests were performed at average temperatures differed from the multi-year average, which is characteristic for the Kraljevo area. The average air temperature was higher for 1.24°C in 2015/16 and 0.17°C in 2016/17 than the multi-year average temperature.

Average amount of precipitation was 10.0 mm lower in 2016/17 and 111.6 mm higher in 2015/16. Starting from the fact that sufficient amounts of precipitation in March and May are very important for the successful production of small grains, it can be concluded that the first year of research (2015/16) had a better or more even distribution of precipitation by months, which increased yields.

It was found that newly created high-yielding varieties of triticale are less responsive to temperature deviations (except extremes) than is the case with precipitation (Djekic et al., 2011; Milovanović et al., 2011; Kendal et al., 2014; Đurić et al., 2016; Terzic et al., 2018). Namely, the total amount of precipitation is reflected in the multi-year average, but the schedule, especially in the critical phases of development, is significantly disturbed. It has been determined that winter precipitation significantly affects the realization of the production potential of wheat (Terzić et al., 2018; Rajičić et al., 2021). In addition to the necessary reserves for the spring part of the vegetation, winter precipitation greatly affects the distribution of easily accessible nitrogen in the soil (Kondić et al., 2012; Lalević et al., 2012; Jelić et al., 2013; Đekić et al., 2018; Djuric et al., 2018; Terzic et al., 2018; Rajičić et al., 2019).

Results and Discussion

Grain yield

The average values of grain yield with different variants of fertilization in winter triticale grown in the Agricultural and Chemical School "Doctor Djordje Radic" in Kraljevo, during the two growing seasons, are shown in Table 2. In the first year of research (2015/16), the Trijumf variety achieved the highest grain yield of 5.876 t ha^{-1} in the T4 treatment fertilized with 120 kg ha^{-1} N, 100 kg ha^{-1} P_2O_5, 60 kg ha^{-1} K_2O, with 5 t ha^{-1} $CaCO_3$ and 20 t ha^{-1} manure, and the lowest yield was achieved by the control (0.970 t ha^{-1}). In the second year of research (2016/17), the highest yield of 5.203 t ha^{-1} was in the T4 variant where a combination of NPK was applied with increased content of phosphorus, lime and organic fertilizers.

Table 2. Grain yield of winter triticale in Kraljevo, Serbia

Fertilization	Years				Average	
	2015-2016		2016-2017			
	$\bar{x}$	Sd	$\bar{x}$	Sd	$\bar{x}$	Sd
C	0.970	0,198	0.810	0.219	0.890	0.214
T1	5.036	0.491	4.500	0.244	4.768	0.462
T2	5.304	0.395	4.761	0.387	5.032	0.467
T3	5.704	0.268	4.999	0.376	5.351	0.482
T4	5.876	0.315	5.203	0.276	5.540	0.452

Source: Authors

In the treatments T2 and T4 in which mineral nutrients with a higher dose of phosphorus were applied, good results in increasing the yield were showed, which is the result of lower content of available phosphorus and high acidity on the examined soil. Agronomic efficiency of phosphorus had a tendency to increase yields with increasing applied doses (Đekić et al., 2014; Terzic et al., 2018; Rajičić et al., 2020a). In studies conducted by Jelic et al. (2015), it is found that the largest increase in yield with one kilogram of nutrient used was in nitrogen, followed by phosphorus, and the least in potassium. Đekić et al. (2014) and Terzic et al. (2018), state that the yield and grain yield components of triticale vary significantly depending on the applied doses of nitrogen, phosphorus and potassium and their mutual combinations and conditions of the growing season, as well as on their complex interactions. In addition to the genotype, the grain yield of winter triticale is greatly influenced by the fertilization system, which is one of the key factors influencing the aount of the formed yield and its quality, but it should be harmonized with climatic and soil conditions and variety requirements (Milovanović et al., 2014; Kondić et al., 2012; Đurić et al., 2015; Đekić et al., 2016; Biberdžić et al., 2017; Madić et al., 2018; Terzic et al., 2018; Rajičić et al., 2020a; Babić et al., 2021). High influence on grain yield by application of mineral, lime and organic fertilizers on acid soils was established by Jelić et al. (2013) and Rajičić et al. (2020b), which is in accordance with our research.

Table 3. The analysis of variance for grain yieldin Kraljevo, Serbia

Effect	df	Mean sqr Effect	Mean sqr Error	F	p-level
Year, (Y)	1, 48	3.425	3.230	1.060	0.308
Fertilization, (F)	4, 45	37.564	0.183	205.383**	0.000
Year x Fertilization, (YxF)	4, 40	0.117	0.108	1.083	0.378

*nsnon significant; *significant at 0.05; **significant at 0.01;*

Source: Authors

During the two-year study, the yield of triticale was higher in all variants of fertilization compared to the control variant, which was confirmed by the analysis of variance where fertilization showed a very significant effect on grain yield (Table 3). Đekić et al. (2014), Jelic et al. (2015), Terzic et al. (2018), Rajičić et al. (2020b) and Tmušić et al. (2021) found that the application of mineral fertilizers had a significant impact on grain yield, ie the yield was significantly higher on variants that were fertilized more intensively. The highest average yield of triticale for all analyzed variants of fertilization was achieved in the production year 2015/16, which is significantly higher than the yield recorded in 2016/17. This is understandable, since in the vegetation year 2016, 121.6 mm more water sediment fell compared to the vegetation year 2017 (Table 1).

Economic efficiency of triticale production

Based on the value of triticale production per hectare, calculations based on variable costs were made. The value of production is determined by multiplying the quantity of products and their market price. The financial result or profit is obtained by subtracting variable costs from the value of production.

Table 4. Calculation of triticale production in T1 variant of fertilization (NP_1K)

Elements of calculation		2016					2017			
		Mea-sure unit	Quantity	Price in RSD	Amount	Struct. cost %	Quantity	Price in RSD	Amount	Struct. cost %
a)	Value of production				85612				81000	
	Mercantile grain	kg	5036	17	85612		4500	18	81000	
b)	Raw material (1+2+3)				26660	58.39			27260	58.93
1.	Seeds	kg	300	45	13500	29.57	300	47	14100	30.48
2.	Mineral fertilizers									
	NP_1K	kg	260	41	10660	23.35	260	41	10660	23.04
3.	Means of protection	1	2.5	1000	2500	5.47	2.5	1000	2500	5.41
c)	Propulsion and labor services (4+5+6)				19000	41.61			19000	41.07
4.	Tractors				9000	19.71			9000	19.45

Elements of calculation		2016					2017			
		Mea-sure unit	Quantity	Price in RSD	Amount	Struct. cost %	Quantity	Price in RSD	Amount	Struct. cost %
5.	Combine harvester				6000	13.14			6000	12.97
6.	Workforce	h	20	200	4000	8.76	20	200	4000	8.65
d)	Total variable costs (b+c)				45660				46260	
e)	The corresponding part of the general costs				2500				2700	
f)	Total costs (d+e)				48160				48960	
g)	Profit (a-f)				37452				32040	

Source: Authors

Variable costs during the production of triticale are: costs of materials (seeds, fertilizers, and pesticides), costs of propulsion machines (tractors, combine harvesters) and labor. Since we examined four different variants of fertilization (without control), we made a separate calculation for each of them (Tables 4, 5, 6 and 7).

Table 5. Calculation of triticale production in T2 variant of fertilization (NP_2K)

Elements of calculation		2016					2017			
		Measure unit	quantity	Price in RSD	Amount	Struct costs %	quantity	Price in RSD	Amount	Struct. costs %
a)	Value of production				90168				85698	
	Mercantile grain	kg	5304	17	90168		4761	18	85698	
b)	Raw materials (1+2+3)				27480	59.12			28080	59.14
1.	Seeds	kg	300	45	13500	29.04	300	47	14100	29.69
2.	Mineral fertilizers									
	NP_2K	kg	280	41	11480	24.70	280	41	11480	24.18
3.	Means of protection	l	2,5	1000	2500	5.38	2.5	1000	2500	5.27
c)	Propulsion and labor services (4+5+6)				19400	40.88			19400	40.86
4.	Tractors				9000	18.97			9000	18.95
5.	Combine harvester				6000	12.64			6000	12.64
6.	Workforce	h	22	200	4400	9.27	22	200	4400	9.27
d)	Total variable costs (b+c)				46880				47480	
e)	The corresponding part of the general costs				2500				2700	
f)	Total costs (d+e)				49380				50180	
g)	Profit (a-f)				40788				35518	

Source: Authors

Based on the obtained data from the calculations of triticale production, in four different fertilization variants (Tables 4-7), we found that, during the research, the value of triticale production and grain yield was increased by applying larger quantities and types of fertilizers (from T1 to T4). The total profit for different fertilization variants during 2016 and 2017 increased from T1 to T2 variant, and then it decreased at T3 and T4 variant, where the profit was the lowest. The decrease in profits in fertilizer variants T3 and T4, in relation to variants T1 and T2, is a consequence of increased costs of mineral fertilizers for lime and organic fertilizers.

Table 6. Calculation of triticale production in T3 variant of fertilization ($NP_1K+CaCO_3$+manure)

Elements of calculation		2016					2017			
		Measure unit	quantity	Price in RSD	Amount	Struct costs %	quantity	Price in RSD	Amount	Struct costs %
a)	Value of production				96968				89982	
	Mercantile grain	kg	5704	17	96968		4999	18	89982	
b)	Raw materials (1+2+3)				59160	72.89			62260	73.89
1.	Seeds	kg	300	45	13500	16.63	300	47	14100	16.73
2.	Mineral fertilizers									
	NP_1K	kg	260	41	10660	13.13	260	41	10660	12.65
	$CaCO_3$	kg	5000	3	15000	18.48	5000	3	15000	17.80
	Manure	kg	20000	1	20000	24.64	20000	1	20000	23.74
3.	Means of protection	l	2.5	1000	2500	3.08	2.5	1000	2500	2.97
c)	Propulsion and labor services (4+5+6)				22000	27.11			22000	26.11
4.	Tractors				10000	12.33			10000	11.87
5.	Combine harvester				6000	7.39			6000	7.12
6.	Workforce	h	30	200	6000	7.39	30	200	6000	7.12
d)	Total variable costs (b+c)				81160				84260	
e)	The corresponding part of the general costs				3000				3300	
f)	Total costs (d+e)				84160				87560	
g)	Profit (a-f)				12808				2422	

Source: Authors

The established values of variable costs for different fertilizer variants, where the largest share falls on the cost of raw materials (seeds, mineral fertilizers, lime, manure and crop protection products), during 2016 varied from 58.39% for variant T1, which is fertilized with mineral nutrients with a lower dose of phosphorus, up to 73.44% in variant T4 which is fertilized with mineral nutrients with a higher dose of phosphorus, lime and manure. Also, the values of variable costs during 2017 varied and ranged from 58.93% for variant T1 to 73.89% for variant T3, which is fertilized with mineral nutrients with a lower dose of phosphorus, lime and manure.

Table 7. Calculation of triticale production in T4 variant of fertilization ($NP_2K+CaCO_3$+manure)

Elements of calculation		2016					2017			
		Measure unit	quantity	Price in RSD	Amount	Struct costs %	quantity	Price in RSD	Amount	Struct. costs %
a)	Value of production				99892				89982	
	Mercantile grain	kg	5876	17	99892		4999	18	89982	
b)	Raw materials (1+2+3)				62480	73.44			63080	73.63
1.	Seeds	kg	300	45	13500	15.87	300	47	14100	16.46
2.	Mineral fertilizers									
	NP_1K	kg	280	41	11480	13.49	280	41	11480	13.40
	$CaCO_3$	kg	5000	3	15000	17.63	5000	3	15000	17.51
	Manure	kg	20000	1	20000	23.51	20000	1	20000	23.34
3.	Means of protection	1	2.5	1000	2500	2.94	2.5	1000	2500	2.92
c)	Propulsion and labor services (4+5+6)				22600	26.56			22600	26.37
4.	Tractors				10000	11.31			10000	11.67
5.	Combine harvester				6000	7.05			6000	7.00
6.	Workforce	h	33	200	6600	7.76	33	200	6600	7.70
d)	Total variable costs (b+c)				85080				85680	
e)	The corresponding part of the general costs				3000				3300	
f)	Total costs (d+e)				88080				88980	
g)	Profit (a-f)				11812				1002	

Source: Authors

The costs of seeds and fertilizers had the highest costs for raw materials.Fertilizer costs varied depending on the type and quantity, so that in 2016 they were the lowest in the T1 variant (23.35%), and the highest in the T4 variant of fertilization (54.63%). In the second year of the research (2017), the costs of fertilizers were the lowest in the T1 variant (23.04%), and the highest in the T4 variant of fertilization (54.25%). With the increase of grain yield, with the increased quantities of applied fertilizers, the variable production costs are increased significantly.

A significant increase in fertilizer costs in wheat production, of 35.75%, was found by Todorović and Filipović (2009), and in triticale production of 57.53%, Biberdžić et al. (2012). In the production of triticale with different variants of fertilization, Biberdžić et al. (2012), point out that the lowest costs of fertilizers were in variant I, which was fertilized with mineral nutrients (28.61%), and the highest in variant III, which was fertilized with a combination of NPK, lime and organic nutrients (57.53%).

Other variable costs, during 2016, were the costs of propulsion machines (tractors and combines) and labor, and they ranged from 26.12% in the T4 variant to 41.61% in the T1 fertilization variant. During 2017, other variable costs ranged from 26.11% for the T3 variant to 41.07% for the T1 fertilization variant. The obtained results of variable costs are similar to the results obtained by Biberdžić et al. (2012), in triticale production and Ivanović et al. (2010) in wheat production in Serbia.

The total variable costs per hectare, in both years of research, were the lowest in the T1 variant of fertilization, and the highest in the T4 variant, which is understandable considering the quantities and prices of applied fertilizers. Increased amounts of applied fertilizers significantly affect the increase in yield (Biberdžić et al., 2017; Đekić et al., 2018; Madić et al., 2018; Terzic et al., 2018; Rajičić et al., 2020b). With the increase in the amount of applied fertilizers, the variable production costs increase, that is, the profitability of production increases (Todorović and Filipović, 2009; Ivanović et al., 2010; Biberdžić et al., 2012).

In order to get a more complete picture of the profitability of triticale production with different variants of fertilization, it is necessary to consider other indicators of success, that is, basic indicators of the degree of economic efficiency (productivity, economy and profitability).

Based on the obtained results in the calculations, a comparison of the obtained triticale yields for all four fertilization variants was performed.

Labor productivity was determined based on the amount of products obtained (grain yield) for all four variants of fertilization per unit time (Table 8).

In the variant T1 which was fertilized with 120 kg ha^{-1} N, 80 kg ha^{-1} P_2O_5 and 60 kg ha^{-1} K_2O during 2016, the highest labor productivity of 251.8 was achieved, and the lowest in the variant T4 (178.1) which was fertilized with 120 kg ha^{-1} N, 100 kg ha^{-1} P_2O_5; 60 kg ha^{-1} K_2O, 5 t ha^{-1} lime and 20 t ha^{-1} manure. This is expected, given that on the T4 variant were spent more hours of working (33 hours) than on the other variants.

During the second year of research, production conditions are worse (uneven amount of precipitation), which is reflected in the decline in yield, so with the same labor costs, in each of the observed variants of fertilization there is a decline in productivity.

Table 8. Production productivity in 2016 and 2017

Elements	Variants of fertilization							
	2016				2017			
	T1	T2	T3	T4	T1	T2	T3	T4
Quantity of obtained products	5036	5304	5704	5876	4500	4761	4999	5203
Total hours of work per hour	20	22	30	33	20	22	30	33
Labor productivity (kg/h) 1/2	251.8	241.1	190.1	178.1	225.0	216.4	166.6	157.7

Source: Authors

The economy of production, which is shown in Table 9, was obtained by comparing the realized value of production and the costs incurred during the production of triticale.

Table 9. Economy of production in 2016 and 2017

Elements	Variants of fertilization							
	2016				2017			
	T1	T2	T3	T4	T1	T2	T3	T4
The value of production (din/h)	85612	90168	96968	99892	81000	85698	89982	89982
Production costs (din/h)	48160	49380	84160	88080	48960	50180	87560	88980
Coefficient of economy 1/2	1.78	1.83	1.15	1.13	1.65	1.71	1.03	1.01

Source: Authors

Based on the obtained coefficients of economy from Table 9, we can conclude that for 1 dinar of invested funds, from 1.13 to 1.83 dinars was obtained of the production value, depending on the variant of fertilization. Triticale production in 2016 was economical, and the highest rate of economy was found in the T2 variant, which is fertilization with an increased dose of phosphorus (NP_2K). In the second year of research, the economy decreases in all variants of fertilization due to bad weather conditions, especially uneven amount of precipitation in critical phases of triticale growth, as well as due to a slight increase in the market price of triticale seeds. This causes a slight decline in the value of production, which is why the coefficient of economy tends to decline slightly. During 2017, as in 2016, the T2 variant (NP_2K) had the highest coefficient of economy (1.71). Biberdžić et al. (2012), found the highest production efficiency in the NP_2K variant fertilized with mineral nutrients with increased phosphorus dose (1.69). Slightly lower coefficients of economy of 1.32 for spelt and 1.20 for wheat, in the conditions of organic farming, were established by Vukoje et al. (2013). The ratio of the

achieved financial result and the value of production represents the rate of profitability shown in Table 10.

In all tested fertilizer variants, the production of triticale in 2016 was profitable, which is shown by the rate of profitability, which ranged from 11.82% to 45.24%. The highest rate of profitability was found in the T2 variant, which is fertilization with increased phosphorus dose (NP_2K), and the lowest in the T4 variant, where a combination of NP_2K, lime and organic fertilizers was used. The low rate of profitability on the T4 variant is the result of a low financial result, that is, realized profit. During 2017, the T2 variant of fertilization also shows the highest rate of profitability.

When it comes to acid soils, their pedo-ameliorative repair measures and high yields, one should not always be guided by the highest yield, because it is often not the most profitable, as our research has shown. High prices of fertilizers significantly increase the price of production, so in order to achieve a satisfactory yield and the most profitable production, it is necessary to choose rational quantities of fertilizers.

Table 10. Profitability rate of production in 2016 and 2017

Elements	Variants of fertilization							
	2016				2017			
	T1	T2	T3	T4	T1	T2	T3	T4
Financial results (din/h)	37452	40788	12808	11812	32040	35518	2422	1002
The value of production	85612	90168	96968	99892	81000	85698	89982	89982
Profitability rate 1/2 x100	43.75	45.24	13.21	11.82	39.56	41.45	2.69	1.11

Source: Authors

In the production of winter triticale, the costs of mineral fertilizers form the largest part of direct costs (Bielski and Falkovski, 2017; Kadakoglu et al., 2021), so it is often not possible to compensate for such high costs with yields. In the conditions of manure application, there is an increase in costs, but also in an increase in yield and better financial results. It is an environmentally justified method that affects product quality (Jelić et al., 2015; Rajičić et al., 2020a).

Conclusions

Sustainable development of agriculture is not possible without the simultaneous achievement of environmental, economic and social goals. The profitability of agricultural production depends on the ratio of prices and production costs, so the reduction of inputs is a condition for achieving profitability in agriculture. More intensive technologies require high costs.

Based on the study of the effects of fertilization on yield, productivity, economy and profitability of triticale production on acidic soils, we have come to the following conclusions:

The value production and grain yield of triticale, during the two-year research (2016 and 2017), increased with the application of larger quantities and types of fertilizers. The total profit, in different variants of fertilization, increased from T1 to T2 variant, and then decreased in T3 and T4 variant, which is a consequence of increased costs of mineral fertilizers, lime and organic fertilizers. The value of variable costs is different, with different variants of fertilization, and the largest part falls on the cost of raw materials. The costs of seeds and fertilizers have the largest share in the costs of raw materials. With the increase of grain yield, and with the increased quantities of applied fertilizers, the variable production costs increase significantly. The total variable costs per hectare, in both years of research, were the lowest in the T1 variant of fertilization, and the highest in the variant T4, which is understandable considering the quantities and prices of applied fertilizers.Increased amounts of applied fertilizers significantly affect the increase in yield.

In the T1 variant which was fertilized with 120 kg ha^{-1} N, 80 kg ha^{-1} P_2O_5 and 60 kg ha^{-1} K_2O, the highest productivity was achieved, and the lowest in variant T4, which was fertilized with 120 kg ha^{-1} N, 100 kg ha^{-1} P_2O_5; 60 kg ha^{-1} K_2O, 5 t ha^{-1} lime and 20 t ha^{-1} manure. This is expected, as more hours of working were spent on the T4 variant than on the other variants.

The highest rates of economy and profitability were found in the T2 variant of fertilization, with increased dose of phosphorus (NP_2K), and the lowest in the T4 variant, where a combination of NP_2K, lime and organic fertilizers was used. Variant T2 can be considered the most profitable and most cost-effective, regardless of the fact that the yield and production value were the highest in variant T4, which was fertilized with a combination of mineral nutrients with increased doses of phosphorus, lime and organic fertilizers.

Our research points to the fact that on acidic soils, the highest yield is often not the most profitable, which is why a rational amount of fertilizer should be chosen.The combination of NPK, lime and organic fertilizers, as well as the application of NPK fertilizers with an increased dose of phosphorus, is necessary in order to increase the fertility of acid soils, and thus the yield of cultivated crops.

Acknowledgement

This paper is part of the project, Grant number 451-03-09/2021-14/200383, financed by the Ministry of Education, Science and Technology Development of Republic of Serbia.

Conflict of interests

The authors declare no conflict of interest.

References

1. Babić V., Rajičić V. & Đurić N. (2021): Economic significance, nutritional value and application of triticale. Economic of Agriculture, 68(4): 1089-1107. doi:10.5937/ekoPolj2104089B
2. Biberdžić, M., Maksimović, G., Barać, S. & Jovović, Z. (2012): Economic effects of triticale production on acid soils. Economic of Agriculture, 59(4): 579-587.
3. Biberdžić, M., Barać S., Prodanović D., Đikić A., Đekić V. & Lalević D. (2017): Impacts of liming and fertilization on yield of two triticale varieties. Proceedings of VIII International Scientific Agriculture Symposium "Agrosym 2017", Jahorina, October 05-08, 577-582.
4. Bielski, S., & Falkowski, J. (2017): Effect of the nitrogen and magnesium fertilization on yield and economic efficiency of winter triticale production. In Proceedings of the 8th International Scientific Conference Rural Development, Akademija, Lithuania, 23-24 November 2017, 17-23.
5. Vukoje, V., Bodroža-Solarov, M., Vučković, J., Košutić, M. & Živković, J. (2011): Economic effects of spelled production in organic farming system. Economics of Agriculture, 1: 80-87.
6. Vukoje, V., Psodorov, Đ. & Živković, J. (2013): Profitability of production of pasta from spelt flour. Economic of Agriculture, 60(2): 265-275.
7. Đekić, V., Milovanović, M., Popović, V., Milivojević, J., Staletić, M., Jelić, M. & Perišić, V. (2014): Effects of fertilization on yield and grain quality in winter triticale. *Romanian Agricultural Research*, 31: 175-183. https://www.incda-fundulea.ro/rar/nr31/rar31.22.pdf
8. Đekić, V., Milivojević, J., Perišić, V., Luković, K., Jelić, M., Janjić & S.,Terzić, D. (2016): Maximum profitability of triticale to optimizing nutrition. Correlations between the triticale yield of mineral nutrition. Proceedings, XX International Eco-Conference® 2016, 9th Eco-Conference® on Safe Food, 28-30. September 2016, Novi Sad, 251-260.
9. Djekic, V., Mitrovic S., Milovanovic M., Djuric N., Kresovic, B., Tapanarova, A., Djermanovic V. & Mitrovic M. (2011): Implementation of triticale in nutrition of non-ruminant animals. African Journal of Biotechnology, 10(30): 5697-5704, DOI: 10.5897/AJB10.986.
10. Đekić, V., Milivojević, J. & Branković, S. (2018): The interaction of genotype and environment on yield and quality components in triticale. Biologica Nyssana, 9(1): September 2018, 45-53, DOI: 10.5281/zenodo.1470850.
11. Djuric, N., Prodanovic, S., Brankovic G., Djekic V., Cvijanovic G., Zilic S., Dragicevic V., Zecevic V. & Dozet G. (2018): Correlation-Regression Analysis of Morphological-Production Traits of Wheat Varieties. Romanian Biotechnological Letters, 23(2): 13457-13465.

12. Đurić, N., Cvijanović, G., Matković, M., Dozet, G., Đekić, V. & Trkulja, V. (2016): Influence of year conditions on grain yield of some winter triticale varieties. Collection of scientific papers of the Institute PKB Agroekonomik, Belgrade, 24-25. February 2016, 22 (1-2): 37-42.
13. Đurić, N., Cvijanović, G., Dozet, G., Matković, M., Đekić, V. & Trkulja, V. (2015): New winter triticale species developed at Institute PKB Agroekonomik. Selekcija i Semenarstvo, 21(1): 9-16. DOI: 10.5937/SelSem1501009D
14. Ivanović L., Subić L. & Jeločnik M. (2010): Analysis of variable costscoverage in wheat production. XV Biotechnology consulting, 15(17): 665-670. Čačak.
15. Jelić M., Dugalić G., Milivojević J. & Đekić V. (2013): Effect of liming and fertilization on yield and quality of oat (Avena sativa L.) on an acid luvisol soil. Romanian Agricultural Research, 30: 249-258. http://incda-fundulea.ro/rar/nr30/rar30.32.pdf
16. Jelic, M., Jelena Milivojevic, Olivera Nikolic,Vera Đekić & Stamenkovic, S. (2015): Effect of long-term fertilization and soil amendments on yield, grain quality and nutrition optimization in winter wheat on an acidic pseudogley. Romanian Agricultural Research, 32: 165-174.
17. Kadakoglu, B., Karli, B., Gül, M. & Özuygur, A. (2021): Economic analysis of triticale production: a case study of Corum province, Turkey. Management, Economic Engineering in Agriculture & Rural Development, 21(3), 483-490.
18. Kendal, E., Tekdal, S. Aktas, H. & Karaman, M. (2014): Determınation Compliance Abilities of Some Triticale Varieties and Comparıson with Wheat in Southeastern Anatolia Condıtıons of Turkey. Communications in Agricultural and Applıed Biologıcal Science, 79(4): 192-200.
19. Kondić, D., Knežević, D. & Paunović, A. (2012): Grain weight of genotypes of triticale (x Triticosecale Wittmack) in agroekological conditions of Banja Luka. Genetics, 44(2): 419-428.
20. Lalević D., Biberdžić M., Jelić M. & Barać S. (2012): The characteristics of triticale cultivated in rural areas. Agriculture & Forestry, 58(2): 27-34.
21. Madić, M., Paunović, A., Đurović, D., Marković, G., Knežević, D., Jelić, M. & Stupar, V. (2018): Grain yield and its components in triticale grown on a pseudogley soil. Journal of Central European Agriculture, 18(5): 184-193.
22. Madić M., Biberdžić M., Đurović D., Paunović A., Knežević D., Stevović V., Tomć D. & Rajičić V. (2020): Grain yield of triticale varieties depending on mineral nutrition. Collection of works XXV Consultations on biotechnology with international participation, 13-14 Mart, Čačak, Serbia, 413-419.
23. Milovanović, M., Staletić, M., Đekić, V., Nikolić, O. & Luković, K. (2011): Seed production and contribution of KG varieties to biodiversity of small grains in the period 2006-2010. 01.-02. decembar 2011, Beograd, Economics of Agriculture, 2(58): 103-111.

24. Milovanovic M., Perishic V., StaleticM., Đekić V., Nikolic O., Prodanovic S. & Lukovic K. (2014): Diallel Analysis of Grain Number per Spike in Triticale. Bulgarian Journal of Agricultural Science, 20(5): 1109-1115. https://www.agrojournal.org/20/05-14.pdf

25. Rajičić V., Milivojević J., Popović V., Branković S., Đurić N., Perišić V. & Terzić D. (2019): Winter wheat yield and quality depending on the level of nitrogen, phosphorus and potassium fertilization. Agriculture and Forestry, 65(2): 79-88. DOI: 10.17707/AgricultForest.65.2.06

26. Rajičić, V., Popović, V., Perišić, V., Biberdžić, M., Jovović, Z., Gudžić, N., Mihailović, V., Čolić, V., Đurić, N. &Terzić, D. (2020a): Impact of Nitrogen and Phosphorus on Grain Yield in Winter Triticale Grown on Degraded Vertisol. Agronomy, 10(6): 757.

27. Rajičić V., Popović V., Terzić D., Grčak D., Dugalić M., Mihailović A., Grčak M. & Ugrenović V. (2020b): Impact of Lime and NPK Fertilizers on Yield and Quality of Oats on Pseudogley Soil and their valorisation. Notulae Botanicae Horti Agrobotanici Cluj-Napoca, 48(4): 2134-2152. DOI:10.15835/48412106

28. Rajičić V., Terzić D., Babić V., Perišić V., Dugalić M., Đokić D. & Branković S. (2021): Yield components and genetic potential of winter wheat on pseudogley soil of Western Serbia. Biologica Nyssana, 12(2): 141-150. DOI: 10.5281/zenodo.5759859

29. Terzic, D., Đekic, V., Jevtic, S., Popovic, V., Jevtic, A., Mijajlovic, J. & Jevtic, A. (2018): Effect of long term fertilization on grain yield and yield components in winter triticale. *The Journal of Animal and Plant Sciences*, 28(3): 830-836.

30. Terzić, D., Đekić, V., Milivojević, J., Branković, S., Perišić, V., Perišić, V. & Đokić, D. (2018): Yield components and yield of winter wheat in different years of research. Biologica Nyssana, 9(2): 119-131.

31. Tmušić, N., Ćirić, S., Nikolić, K., Knežević, J. & Rajičić, V. (2021): Effects of different fertilization treatments on the yield performance, yield parameters and grain quality of winter wheat grown on vertisol soil type. *Applied Ecology and Environmental Research*, 19(6): 4611-4627. DOI: http://dx.doi.org/10.15666/aeer/1906_46114627

32. Todorović S., Filipović N. (2009): Economic analysis of wheat production on family farms. *Proceedings of the IV Symposium „Innovations in Crop and Vegetable Production"*. Faculty of Agriculture Belgrade, Serbia, pp. 64-65.

33. SAS/STAT (2000): User's Guide, Version 9.1.3. SAS Institute Inc.

DYNAMICS OF SPA TOURISM STATISTICS IN SELECTED COUNTRIES OF CENTRAL AND EASTERN EUROPE

Jelena Čeperković[1], Slobodan Čerović[2]

**Corresponding author E-mail: jelena.ceperkovic@gmail.com*

ARTICLE INFO

Original Article

Received: *29 December 2022*

Accepted: *25 February 2023*

doi:10.59267/ekoPolj2301217C

UDC 338.48-6:615.83(4-11)(4-191.2)

Keywords:

spas Covid-10 pandemic, tourim development, Central and Eastern Europe

***JEL**:L83*

ABSTRACT

Spas were attracting visitors since ancient times. Study aims to monitor the changes in spa tourism statistics in the period of 2010-2020 for the selected countries of Central and Eastern Europe (Croatia, Hungary, Serbia and Slovenia), with particular attention given to the average development rate (ADR) and average growth rate (AGR), and overnight stays and an average length of stay. The reference to the consequences of the Covid-19 pandemic on overnight stays and an average length of stay was discussed as well. Moreover, upon analysis of the existing tourism data for the period of 2010-2020, prediction of the post-pandemic period (until 2023-2025) was also implemented with the use of a linear model. In addition, using the broad criteria of a four-night stay as a minimum stay for medical treatments, Serbia has shown the characteristics of a medical spa, while Slovenia and Croatia could be characterized as "wellness medical", and finally Hungary was considered as a wellness spa destination.

Introduction

Humans, to a greater or lesser extent, were looking to find a way to take care of their health. Hence, travel to places with mineral and thermal springs was familiar to people from the earliest times. Spa tourism in Europe dates from ancient times, as the earliest reference to spas has been made in Ancient Greece and Rome (Huang et al., 2022). Ancient Greeks and Romans exploited the healing potential of spas and their natural environment to improve their overall well-being (Aluculesei et al., 2021). For example, in ancient Rome, 2000 years ago, the Baths of ancient Rome were perceived as leisure, social, tourism and pleasure phenomena. Acronym spa comes from the

1 Jelena Čepreković, PhD candidate, Singidinum University, Faculty of Tourism and Hospitality Management, Danielova 32, 11000 Belgrade, Serbia, Phone: +381113094041, E-mail: jelena.ceperkovic@gmail.com, ORCID ID (https://orcid.org/0000-0002-5183-6436/)

2 Slobodan Čerović, full professor, Singidinum University, Faculty of Tourism and Hospitality Management, Danielova 32, 11000 Belgrade, Serbia, Phone: +381113094041, E-mail: scerovic@singidunim.ac.rs, ORCID ID (https://orcid.org/0000-0002-4646-2476)

Latin phrase "salus per aquam" placing the care of body, mind and spirit in focus. The value of spas was even more pronounced nowadays, as thermo-mineral springs have remained to be a place of visitation and healing (both physical and mental) up to this day. Thus, according to World Spa Organization (n.d), "health and wellness market size worldwide was estimated at over 4.4 trillion U.S. dollars in 2019, a figure which is set to increase to over six trillion U.S. Dollars by 2025."

Spa tourism has evidenced an evolution from initial travel to a place with thermo-mineral water with a healing function focused on recovery or curation to modern spa centers turned and equipped with state of art medical equipment, not only directed to the healing process, yet prevention and with particular attention given to wellness services. With the outbreak of the Covid-19 pandemic, tourism on a global scale was exposed to restrictive measures such as lockdowns, travel bans, and restrictions on public gatherings leading to a loss of USD 1.3 trillion in export revenues and a 75% decrease in the number of international tourist arrivals (UNWTO, 2021). Therefore, the Covid-19 pandemic forced the productive sector of spa tourism to resituate itself (Pinos Navarrete & Shaw, 2021). Interestingly, despite the evident slowdown of all tourism activities globally, the pandemic crisis has also triggered novel opportunities for spas since the urge for both prevention and recovery of illness has boosted demand for spas and their treatments. Hence, spas' therapeutic role was emphasized not only during the pandemic crisis, yet in the post-recovery process as well (Aluculesei et al., 2021; Martínez-Moure & Saz-Peiró, 2021; Šenková et al., 2021). A large number of spas in Europe have shown socially responsible behavior by opening their facilities to infected patients and healthcare personnel to accelerate their recovery process (Antonelli & Donelli, 2020; Lakićević et al, 2023). To conclude, spa tourism, especially in countries with a long tradition of this specific form of tourism, was identified as an instrument to battle the challenges of a pandemic crisis on tourism in general (Šenková et al., 2021). Moreover, according to Rančić Demir et al. (2022) as a result of the pandemic international travel bans, tourists were persuaded to consider traveling to domestic destinations, especially those in spas with health and wellness services. Simultaneously, the influx of tourists, especially domestic to the spa destinations resulted in an accelerated trend when it comes to overnight stays. Taking into account the huge changes in post-modern society and the enormous effect of the Covid-19 pandemic on the spa tourism evolution, the contemporary evolution of prosperity, however, ignored market of Central and Eastern Europe was investigated. It will be interesting to acknowledge if the Covid-19 pandemic has changed considerably the spa tourism flows, especially those regarding overnight stays and the average length of the tourist stays.

Hence, the paper aims to examine the longitudinal changes in spa tourism phenomena (2010-2020), with particular reference to the overnight stays and average length of the tourists' stay in the selected spa tourism destinations in Central and Eastern Europe (Croatia, Hungary, Serbia and Slovenia), taking into account that investigated region has a long tradition of balneotherapy as an inseparable part of the region's cultural heritage (Varga, 2019). The choice of overnight stays and the average length of the

tourists' stay as indicative spa tourism indicators were based on the argument made by Šenková et al. (2021, p. 7) that „in spa tourism, the number of overnight stays is an important economic indicator, especially due to the specific requirements for a longer stay". The data was observed in the period starting from 2010 to 2020, with special reference given to the effects of the Covid-19 pandemic on spa tourism overnight stays and to a prediction of its growth for a post-pandemic period. The contribution of the paper is related to the fact that spa tourism data for selected Central and Eastern European countries were not systemized so tedious at one place in previous tourism literature, at the same time allowing us to understand the pandemic crisis effects on each of investigated markets and to acknowledge its particularities based on the criteria of an average length of stay. Finally, the study provided an opportunity to model the growth of this market (and countries within it) in the post-pandemic period.

Literature review

Spa tourism basics

Interest in health tourism has received increasing attention since the middle of the previous decade (Smith & Puczkó, 2015). Tourists' concern for improving health and quality of life is the leading motivating factor for traveling from one place to another (Tomka et al., 2015). Health tourism is a term that is commonly used by numerous researchers in tourism (Sarker et al., 2022). It appears as one of the oldest forms of tourism (Asadi & Daryaei, 2011), and represents a significant motivational driver for the movement of tourists at the beginning of the twentieth century (Hall, 2011). Travel and health are interrelated concepts, as tourism activities promote the physical, mental and emotional state of travelers/tourists (Yoo et al., 2015). Although many governments use health tourism as a synonym for medical tourism, a clear distinction should be made between the concepts that belong to this form of tourism (Smith & Puczkó, 2013). Health tourism includes sub-sectors such as spa, wellness and medical tourism (Manna et al., 2020; Rodrigues et al 2017; Smith & Puczkó, 2013).

Medical tourism, as a branch of health tourism, involves the travel of patients abroad in search of medical care, which includes optional and special treatments, major/minor operations, as well as routine controls (Garcia-Altes, 2005). *Wellness tourism* involves "tourists in good health who are looking for treatments that will enable them to maintain that status" (Unković & Zečević, 2000, p. 295). The concept of health is often associated with wellness since health tourism is aimed at promoting a healthy lifestyle and opportunities for recreation and general well-being (Pessot et al., 2021). Today, wellness experts recognize the following trends, such as: "dirty wellness" - the health of the world's soil and the impact of soil exposure on human health; urban baths and wellness playgrounds; innovative technology (devices that collect data for a wide range of individual health conditions); wellness travel - welcoming travelers ready for post-pandemic adventure; a healthier lifestyle for the elderly; the rise to the wellness metaverse (Global wellness summit, 2022).

The spa is one of the sub-sectors of health tourism that is located between the medical and wellness sectors, depending on the purpose and type of treatment received when visiting spas (Smith & Puczkó, 2009). According to the Short Dictionary of Tourism (cited in Šenková et al., 2021, p. 3) spa tourism is defined as "a type of tourism focused on health-preventive and therapeutic activities under professional supervision in leisure time". In Europe, spas are commonly traditional and used for medical purposes (Jakubíková et al., 2019), but over time visitors also come for the natural environment, social contacts and cultural experiences (Šenková et al., 2021). The current social role of spas, in the form of health care and health prevention, is undergoing significant changes (Szromek & Naramski, 2019). People are turning more toward healthy lifestyles and trying to adapt these elements to their life, as well as to integrate the wellness component into it (Buzsik et al., 2015). The historical evolution of spas could evidence different phases (medical, wellness), while nowadays, spa tourism encircles additional experiences such as aromatherapy, yoga, pilates, etc. (Travis, 2011). Many spas have increased their revenues due to increased demand for wellness tourism and increased spending on wellness and wellness-related items (Rodrigues et al., 2022). Spa providers must adapt to the changing wants and needs of service users, and continue to improve the spa experience (Smith & Puczkó, 2009). Some of the challenges include changes that include: changing the spa concept - from enjoyment to wellness; monitoring changes regarding the profile of consumers in spas; spa facilities directed not only for women but also for men, as well as for all age groups of people; providing a more comprehensive range of treatments and services; and providing information to potential consumers in line with technological progress (Smith & Puczkó, 2009). Over time, a mixture of medical spa and wellness has emerged in the form of "medical wellness". European Spa Association defines medical wellness as "medical diagnostics and various treatment techniques with elements of wellness that generate the holistic improvement of health, well-being, and subjective perceptions of health and prevention" (EuropeSpa, 2022, p. 3).

Smith and Dryglas (2021, p. 67) argue that "many traditional medical spas, especially in Central and Eastern Europe, were originally funded or subsidized by national governments because they provided health services for residents and domestic tourists. However, in recent years, many spas have been underfunded and were expected to attract guests on the free market, including international tourists. This represents a major challenge, as international tourists may expect wellness rather than medical facilities or higher quality facilities than the spas can currently afford to offer". Some projects, for example, WellSpaV4 (Czech Republic, Hungary, Poland and Slovakia) examined the mixture of wellness services and spa tourism, particularly in the context of traditional (medical) spas (Šenková et al., 2021).

Spa tourism-changes in the demand

Modern civilization has brought substantial changes to everyday life. A hectic pace of life has altered daily routines and reduced available leisure time leading to stress and

eventually growth of the stress-induced illness. Globally, it is an evident trend of the aging population so the promotion of healthy lifestyles wellness and spa tourism has expanded rapidly in the last few years (Dillette et al., 2020). The intensive development of health tourism implies the differentiation and continuous adaptation of certain products to changes in global demand. Demand trends are changing, largely driven by demographic changes (Buzsik et al., 2015). Satisfying "health tourists" is a challenging task that requires constant effort (Sarker et al., 2022). Tourists expect a mix of health treatments, such as conventional and alternative health treatments as part of wellness tourism to improve their health and well-being (Majeed & Kim, 2022). The economic growth worldwide combined with increased life expectancy, are very significant drivers of demand for some forms of health tourism, particularly spas (Yuan et al., 2017).

Nowadays, more and more people are looking for healthier lifestyle options that could be practiced within the spas (Dryglas & Rozycki, 2017). Thus, companies worldwide have realized the benefits of using spa retreats in reducing workplace stress and sickness-related absenteeism (Smith & Puczko, 2015). Moreover, spas were not exclusively recognized as places of health recuperation, yet as wellness-oriented destinations focused on beauty and relaxation treatments (Dimitrovski & Todorović, 2015). Modern-day spas reflect the notion of "lifelong wellness", a mixture of "complementary and alternative therapies and medicines" at the crossroad of beauty, relaxation and medical approaches (Smith & Puczko, 2015, p. 217). These novel treatments have resulted in higher demand for novel in comparison to traditional spa services, particularly in the Balkan countries (Sziva et al., 2017), minimizing the importance of traditional medical features in spas in contrast to preventive aspects (Pinos Navarrete & Shaw, 2021). Conversely, as an outcome of the pandemic, Aluculesei et al. (2021) argue that over time tourists have started to prefer the medical spa as a result of the healthy lifestyle trend. Unfortunately, there is a limited number of studies that monitor the changes in the tourism demand for spa tourism in selected destinations within Central and Eastern Europe, regardless of its abundant historical spa heritage.

According to Smith and Puczko (2015) profile and motivations of thermal spa tourists in Central and Eastern Europe is considerably different from tourists visiting leisure or beauty spas. However, in parallel a process of "spaization" was acknowledged, blurring the boundary between traditional spas directed to the use of thermal and mineral waters and emerging spas using non-mineral water (Smith & Puczko, 2010). However, with the outbreak of the Covid-19 pandemic, medical facilities in spas have once again gained importance, especially in the recovery and post-recovery process of infectious diseases. Hence, Rančić Demir et al. (2022) perceive the coronavirus pandemic as an opportunity for "transformative resilience" of spa offer. Conversely, Pinos Navarrete and Shaw (2021) argued that during the pandemic spa business activity was significantly reduced, while some of the spas were temporarily closed.

It is interesting to note that recreational spa's economic benefits should come from the ampleness of shorter stays driven by wellness issues, while a stable influx of tourists in medical spas comes as a consequence of the recognition of medical spas within

European healthcare systems (Aluculesei et al., 2021). Initially, within the region of Central Europe, medical spa stays were from 21 or 28 days paid by health insurance companies (Derco, 2020), while Rodrıguez Miguez (2010) argues that traditional medical spa treatments require a longer stay of at least 11 continuous days, in contrast to wellness treatments that commonly last from several minutes to hours, not more than several days. In the meanwhile, some medical facilities have offered shorter (minimum of four nights) effective medical treatments (Šenková et al., 2021). Thus, this value could be used as an optimal threshold for the differentiation of the spa destination profile.

In the case of Slovenia, modern wellness treatments were attractive due to the "mutual complementarity of health and tourism functions" (Rančić Demir et al., 2022, p. 287). In Serbia, health or rehabilitation spa tourism financed by the state plays the most important role for domestic tourists, otherwise, most of them would not be able to afford a wellness and spa vacation. Moreover, both Serbia and Hungary support domestic spa tourism through the use of holiday vouchers. In Hungary, these vouchers were subsided by spas and/or reimbursed by the National Health Insurance Fund of Hungary (Surugiu et al., 2021). Thus, insight into the number of overnight stays and the average length of the stay would provide insight into the market dynamics, of importance for predicting future growth and the type of spa destination.

Methodology

The study uses a quantitative approach to analyzing secondary data obtained from the official websites of the statistical offices of the analyzed countries. The secondary data was collected for the second decade of the 21st century (2010-2020), trying to acknowledge the contemporary dynamics of the spa tourism phenomena. Moreover, an outbreak of the health crisis (covid-19 pandemic) was also acknowledged since the last observed year taken for the analysis was a year of the Covid-19 pandemic. Neighboring countries in the region of Central and Eastern Europe (Serbia, Croatia, Slovenia and Hungary) were considered, due to the long tradition of chosen countries in the context of spa tourism, and its distinctive spa tourism evolution over the years, particularly after the Second World War (Paunović, 2013). The initial phase of the development of spa tourism in investigated countries comes as a result of the unique economic and political environment (socialism), advancing the medical spa concept as state planned project. With the beginning of the transition process towards capitalism in Hungary, the wellness aspects were becoming more and more pronounced within their spa offer.

The data included most significant tourism statistics aspects such as those more general on a national level (Total number of tourists visits and overnight stays) and spa tourism destination specific (Total number of spa visits, Total number of spa overnight stays and The average length of stay in spas). Comparative analysis was made between the proposed destination, with a particular focus on the overnight stays and average length of the stay in spas following previous literature in the field (Šenková et al., 2021). In addition, longitudinal analysis was deployed to monitor the changes between the selected spa destination from 2010 to 2022, and with a prediction to 2025.

The study implemented the following quantitative analyses. To acknowledge the contemporary dynamics of spa tourism development, mathematical formulas assessing both average development rate (ADR) and average growth rate (AGR) were assessed. Moreover, a mathematical linear model was conceptualized to depict the dynamics of the number of overnight stays in spas within the observed period and also to predict its growth in the forthcoming years. Finally, an evaluation of the type of „spa tourism" for each of the investigated destinations grounded on the comparative analysis of the average length of stay using a criterion of minimal length for effective medical treatment in spas (four nights according to Šenková et al., 2021) between chosen spa destinations was implemented.

Results

The tables (Table 1 to Table 4) systemized the statistical data regarding spa visitation for the previous decade (2010-2020), with both national and (spa) destination data in the selected countries of Central and Eastern Europe region (Serbia, Hungary, Croatia and Slovenia). Table 1 provides insight into Serbia's spa data statistics.

Table 1. Serbia tourism and spa statistics (2010-2020)

Year	Total number of overnights stays	Total number of spa visits	Total number of spa overnight stays	The average length of stay in spas	Share of spa overnight stays to the total number of overnight stays in Serbia %
2010.	6.413.515	386.499	1.986.735	5,14	30,98
2011.	6.644.738	375.473	2.308.435	6,15	34,74
2012.	6.484.702	347.192	2.035.938	5,86	31,40
2013.	6.567.460	405.768	2.134.497	5,26	33,00
2014.	6.086.275	386.345	1.852.036	4,79	30,43
2015.	6.651.852	427.456	1.854.582	4,34	27,88
2016.	7.599.739	477.102	2.085.044	4,37	27,44
2017.	8.325.144	519.151	2.227.945	4,29	26,76
2018.	9.336.103	596.884	2.542.391	4,26	27,23
2019.	10.073.299	670.044	2.781.627	4,15	27,61
2020.	6.201.290	522.947	2.184.602	4,18	35,23

Source: Statistical Office of the Republic of Serbia

Table 2 systemized tourism and spa statistics for Hungary from 2010 to 2020.

Table 2. Hungary tourism and spa statistics (2010-2020)

Year	Total number of overnights stays	Total number of spa visits	Total number of spa overnight stays	The average length of stay in spas	Share of spa overnight stays to the total number of overnight stays in Hungary %
2010.	104.700.000	29.489.000	33.913.000	1,15	32,39
2011.	102.700.000	32.023.000	36.186,000	1,13	35,23
2012.	102.000.000	35.439.000	40.257,000	1,14	39,47
2013.	105.500.000	38.394.000	42.426,000	1,11	40,21
2014.	110.000.000	37.911.000	44.591,000	1,18	40,54
2015.	107.000.000	40.241.000	47.618,000	1,18	44,50
2016.	107.000.000	41.096.000	51.011,000	1,24	47,67
2017.	107.200.000	41.363.000	51.704.000	1,25	48,23
2018.	105.700.000	41.777.000	53.057.000	1,27	50,19
2019.	100.700.000	42.051.000	54.246.000	1,29	53,86
2020.	62.800.000	19.147.000	39.826.000	2,08	63,42

Source: Hungarian Central Statistical Office

Table 3 systemized the tourism and spa statistics for Slovenia for the previous decade.

Table 3. Slovenia tourism and spa statistics (2010-2020)

Year	Total number of overnights stays	Total number of spa visits	Total number of spa overnight stays	The average length of stay in spas	Share of spa overnight stays to the total number of overnight stays in Slovenia %
2010.	9.883.920	654.056	2.752.718	4,21	27,85
2011.	10.413.012	680.910	2.865.128	4,21	27,51
2012.	10.604.352	794.029	3.255.520	4,10	30,70
2013.	10.708.408	801.857	3.175.355	3,80	29,65
2014.	10.738.766	811.927	2.998.959	3,69	27,93
2015.	11.653.764	850.126	3.035.654	3,57	26,05
2016.	12.647.876	892.048	3.165.561	3,45	24,75

Year	Total number of overnights stays	Total number of spa visits	Total number of spa overnight stays	The average length of stay in spas	Share of spa overnight stays to the total number of overnight stays in Slovenia %
2017.	14.208.545	944.738	3.310.184	3,50	23,30
2018.	15.694.705	1.112.921	3.642.651	3,27	23,21
2019.	15.775.331	1.193.346	3.701.669	3,10	23,46
2020.	9.204.374	630.408	2.250.228	3,57	24,45

Source: The Statistical Office of the Republic of Slovenia

Finally, Table 4 systemized the tourism and spa statistics for Croatia within the observed period.

Table 4. Croatia tourism and spa statistics (2010-2020)

Year	Total number of overnights stays	Total number of spa visits	Total number of spa overnight stays	The average length of stay in spas	Share of spa overnight stays to the total number of overnight stays in Croatia %
2010.	56.217.000	107.000	363.000	3,39	0,65
2011.	60.110.000	110.000	365.000	3,32	0,61
2012.	62.507.000	106.000	357.000	3,37	0,57
2013.	64.617.000	118.000	358.000	3,03	0,55
2014.	66.270.000	129.000	397.000	3,08	0,60
2015.	71.437.000	148.000	436.000	2,96	0,61
2016.	77.918.855	172.000	523.000	3,04	0,67
2017.	86.200.201	201.000	590.000	2,93	0,68
2018.	89.651.789	207.000	612.000	2,96	0,68
2019.	91.242.931	218.000	625.000	2,87	0,68
2020.	40.794.455	140.000	346.000	2,47	0,68

Source: The Croatian Bureau of Statistics

Taking into account the previous tables (Tables 1 to 4), it could be concluded that the number of overnight stays in spas is the highest in Hungary followed by Slovenia, and Serbia, while the lowest is in Croatia. However, taking into account the number of total inhabitants and the total number of spa tourists who visited examined tourist destination, it could be argued that the largest share of overnight stays and visits to

spas belongs to Hungary (about 75%), followed by Slovenia (20%), Serbia (17%) and lastly for Croatia (1%). The explanation for this finding lies in the fact that Serbia and Hungary were not seaside destinations, while Croatia has invested all the efforts in tourism promotion of their Adriatic coast. On another hand, Slovenia has also well-renowned seaside destinations, and, at the same time, it allocated large funds for the development of spa tourism. Table 5 showed the share of overnight stays for peak years within the investigated period of time.

Table 5. Share of an overnight stay in spas in contrast to the total number of overnight stays in the country

Country	The maximum value of a share of spa overnight stays within the total number of overnight stays	Year
Hungary	63,42	2020
Serbia	35,23	2020
Slovenia	30,70	2012
Croatia	0,68	2019, 2020

Source: Authors' calculations

Taking into account the dynamics of spa tourism development, the average development rate (ADR) and average growth rate (AGR) were assessed. The above indicators define the trend of spa tourism development in each destination. The average development rate is obtained based on the following formula

ADR = (Yn – Y1)^(1/(n-1).

In the previous formula, Yn stands for the number of overnight stays in the last year of the observed period (2020) and Y1 is the number of overnight stays in the first year of the observed period (2010). The average growth rate is then calculated according to the formula

AGR = ADR-1.

The number of observed years is n=11. Table 6 present the results for ADR and AGR for each of the investigated destinations.

Table 6. Average development rate (ADR) and average growth rate (AGR) for investigated destinations over 11 years

Country	ADR	AGR
Serbia	1,009	- 0,009
Hungary	1,016	- 0,016
Slovenia	0,98	0,02
Croatia	0,995	0,005

Source: Authors' calculations

Table 6 indicates a decrease in average growth rate (AGR) for Hungary and Serbia mostly as a result of the pandemic outbreak in 2020, however, in the terms of average development rate (ADR) increase in the number of tourists in the spas and their number of overnight stays in the same countries was recognized.

Moreover, a mathematical model capable to depict the dynamics of the number of overnight stays in spas, to predict its growth in the forthcoming years was proposed. The study proposed a linear model due to its applicability in the study context, and as a result of researchers' awareness of possible error within the calculation and possible model adjustments to resolve this specific issue.

The annual number of overnight stays was defined by the following formula

$Yt = b0 + b1 * x$, where

$b0 = \sum Yi /n$,

$b1 = \sum x * Y / \sum x2$.

Coefficient b1 is the slope of the true linear distribution and shows an increase in the number of overnight stays, and b0 is the average number of overnight stays for the observed period of 11 years. Table 7 showed the results of a linear model for spas in Serbia over the examined period of time.

Table 7. Results for the linear model of overnight stays in spas in Serbia

Year	X	Number of overnight stays in spas (000 000) Y	XY	X^2
2010	-5	1.986	-9.93	25
2011	-4	2.308	-9.232	16
2012	-3	2.036	-6.108	9
2013	-2	2.134	-4.268	4
2014	-1	1.852	-1.852	1
2015	0	1.854	0	0
2016	1	2.085	2.085	1
2017	2	2.228	4.456	4
2018	3	2.542	7.626	9
2019	4	2.781	11.124	16
2020	5	2.185	10.925	25
	0	23.991	4.826	110

Source: Authors' calculations

$b_0 = 2,181$

$b_1 = 0,039$

$Y_t = 2,181 + 0,039 * x$

Table 8 showed the results of a linear model for spas in Hungary over the examined period.

Table 8. Results for the linear model of overnight stays in spas in Hungary

Year	X	Number of overnight stays in spas (000 000) Y	XY	X^2
2010	-5	33.913	-169.565	25
2011	-4	36.186	-144.744	16
2012	-3	40.257	-120.771	9
2013	-2	42.426	-84.852	4
2014	-1	44.591	-44.591	1
2015	0	47.618	0	0
2016	1	51.011	51.011	1
2017	2	51.704	103.408	4
2018	3	53.057	159.171	9
2019	4	54.246	216.984	16
2020	5	39.826	199.13	25
	0	494.835	165.181	110

Source: Authors' calculations

$b_0 = 44,985$

$b_1 = 1,502$

$Y_t = 44,985 + 1,502 * x$

Table 9 showed the results of a linear model for spas in Slovenia over the examined period.

Table 9. Results for the linear model of overnight stays in spas in Slovenia

Year	X	Number of overnight stays in spas (000 000) Y	XY	X^2
2010	-5	2.752	-13.76	25
2011	-4	2.865	-11.46	16
2012	-3	3.255	-9.765	9
2013	-2	3.175	-6.35	4

Year	X	Number of overnight stays in spas (000 000) Y	XY	X^2
2014	-1	2.998	-2.998	1
2015	0	3.035	0	0
2016	1	3.165	3.165	1
2017	2	3.31	6.62	4
2018	3	3.642	10.926	9
2019	4	3.701	14.804	16
2020	5	2.25	11.25	25
	0	34.148	2.432	110

Source: Authors' calculations

$b_0 = 3,104$

$b_1 = 1,502$

$Y_t = 3,104 + 0,022 * x$

Table 10 showed the results of a linear model for spas in Croatia over the examined period.

Table 10. Results for the linear model of overnight stays in spas in Croatia

Year	X	Number of overnight stays in spas (000 000) Y	XY	X^2
2010	-5	0.363	-1.815	25
2011	-4	0.365	-1.46	16
2012	-3	0.357	-1.071	9
2013	-2	0.358	-0.716	4
2014	-1	0.397	-0.397	1
2015	0	0.436	0	0
2016	1	0.523	0.523	1
2017	2	0.59	1.18	4
2018	3	0.612	1.836	9
2019	4	0.625	2.5	16
2020	5	0.346	1.73	25
	0	4.972	2.31	110

Source: Authors' calculations

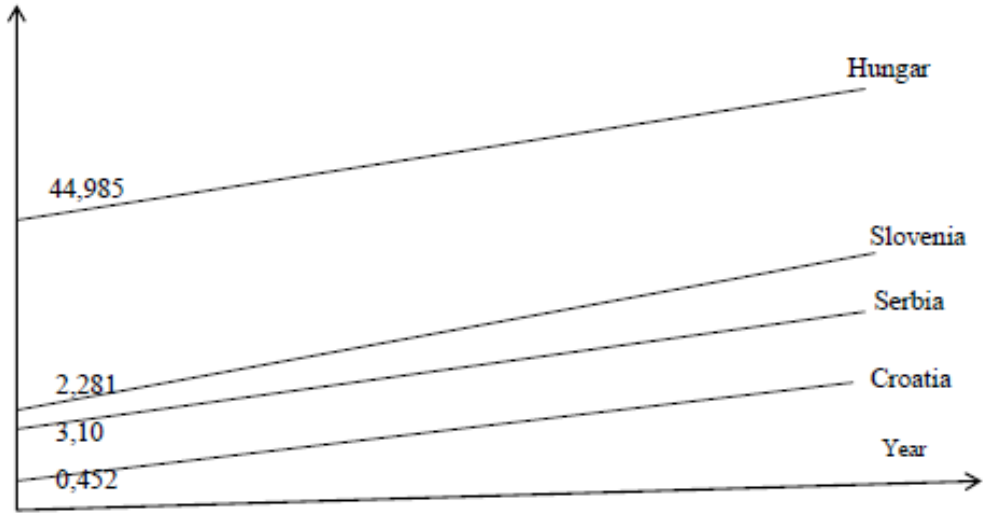
$b_0 = 0{,}452$

$b_1 = 0.021$

$Y_t = 0{,}452 + 0.021 * x$

Based on mathematical models of linear distribution, it could be concluded that trends in the number of overnight stays for all of the observed countries (Serbia, Hungary, Slovenia and Croatia) are increasing over the years.

Figure 1. Identified trends within the proposed linear model for investigated destinations over the observed period (2010-2025)



Source: Authors' calculations

The main advantage of the proposed linear model is the possibility of predicting the number of overnight stays in the forthcoming years. Namely, the values of h change in the displayed tables from -5 to 5, acknowledging the study time-frame starting from 2010 to 2020. If the Yt value is calculated for h=8, the forecasted number of overnight stays in 2023 is obtained, for h=9 the forecasted number of overnight stays in 2024, etc. For individual countries, the predicted values of the number of overnight stays are given in the following overview. Estimated number of overnight stays for individual countries:

Serbia

For h=8, i.e. 2023, Yt=2.493 million number of overnight stays is predicted,

For h=9, i.e. 2024, Yt=2.532 million number of overnight stays is predicted,

Therefore, in 2024, more than 2,500,000 overnight stays in spas are expected in Serbia, which represents an excellent result in the context of the development of spa tourism in Serbia.

Hungary

For h=8, i.e. the year 2023, Yt=57 million number of overnight stays is predicted,

For h=9, i.e. 2024, it is predicted that Yt=58.5 million overnight stays,

As can be seen from Figure 1 and based on the obtained values, Hungary would eventually also records a considerable increase in the number of tourists in its spas in the forthcoming period.

Slovenia

For h=8, i.e. 2023, it is predicted that Yt=3.28 million overnight stays,

For h=9, i.e. 2024, it is predicted that Yt=3.3 million overnight stays,

In 2024, 3,300,000 overnight stays are expected in Slovenia, which in absolute terms is more than in Serbia. Moreover, taking into account the fact that Slovenia has 2.5 times less population in comparison to Serbia, it can be concluded spa tourism in Slovenia would continue its boom in the forthcoming years.

Croatia

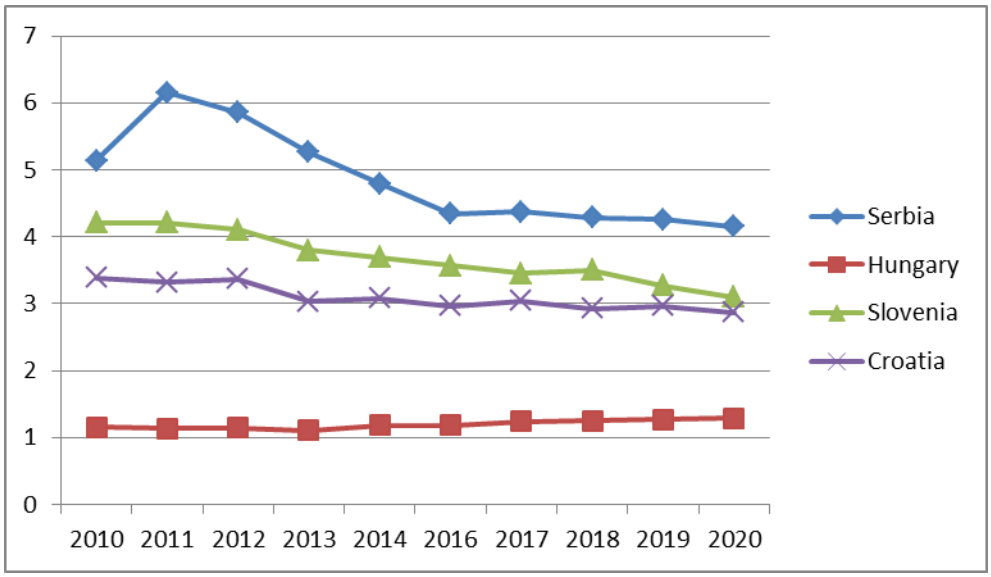
For h=8, i.e. 2023, Yt=0.62 million number of overnight stays is predicted,

For h=9, i.e. 2024, Yt=0.641 million number of overnight stays is predicted,

As mentioned earlier, due to the Adriatic coast, spa tourism in Croatia has a significantly lower number of overnight stays, which is compensated by tourist visitation to seaside destinations, generating considerably higher tourism income for Croatia in comparison to Serbia and Slovenia.

Finally, each of the investigated destinations' average length of stay in spas was further examined to acknowledge the evolution of spa tourism regarding the destination offers (Figure 2). According to Šenková et al. (2021), a criterion of four nights for the minimal length of stay for effective medical treatment in spas was used. Based on the predetermined threshold, Serbia was perceived as a medical spa destination close to the threshold with the end of the observed period and an outbreak of the pandemic, while Slovenia has initially been profiled as a medical spa at the beginning of the previous decade, however, nowadays with an average of 3 nights per stay belong to a type of "medical wellness" destination. Both Hungary and Croatia were well above the predetermined threshold, therefore they are perceived as wellness spa destinations, which is particularly obvious in the case of Hungary. It is interesting to note that Hungary was the sole destination that increased the length of stay with the outbreak of a pandemic, suggesting its re-definition towards richer tourism offer that might secure longer stays, presumably as a combination of wellness and medical features, or as it has been above emphasized in the form of "medical wellness" (EuropeSpa, 2022).

Figure 2. Dynamics of an average length of stay in spas in the period from 2010 to 2020 in the observed destinations



Source: Authors' calculations

Discussion and concluding remarks

Countries in Central and Eastern Europe selected for the study (Serbia, Hungary, Slovenia and Croatia) experienced increased growth in spa tourism over the observed period (2010-2019). With the outbreak of the Covid-19 pandemic, chosen countries had more or fewer difficulties. For example, those that are continental such as Serbia and Hungary have exploited this health crisis to accelerate the number of overnight stays, in contrast to Slovenia and Croatia. Moreover, favoring domestic tourism and extended stays in spas was found to be a powerful instrument to battle the worldwide challenges of travel bans, demonstrated especially in the context of the number of overnight stays in Serbia and Hungary in contrast to the initial year of evidence (2010). The pandemic resilience of spa tourism was also noted for Hungary (63,42%) and Serbia (35,23%) concerning the maximum value of a share of spa overnight stays within the total number of overnight stays shown in these destinations. Moreover, Serbia and Hungary showed successful results also in the context of the Average development rate (ADR). The proposed linear model suggests that there is an increasing growth of one of the main criteria regarding spa tourism success, the total number of overnight stays as previously discussed in the Šenková et al. (2021) study.

Finally, concerning the spa destination typology average length of stay was assessed to get insight into the dominant type of services and accompanying experience provided at the spa destination. It is interesting that the previously discussed process of "spaization" is related to blurring the boundary between traditional spas and emerging spas (Smith

& Puczko, 2010) or medical and wellness perspective. It is also in the line with the lifestyle expression of post-modern society, such as, among others aromatherapy, yoga, and pilates with preference given to the well-being perspective (Travis, 2011). Serbia was positioned as more oriented towards classical medical spa treatments, commonly used by health care users mainly within the recovery process. On another end of the spa destination offer-related typology Hungary was positioned, with a minimal length of stay and thus, a significant focus on prevention and wellness in the form of "lifelong wellness" as a mixture of beauty, relaxation and medical approaches (Smith & Puczko, 2015). It is interesting to note that Hungary used the "opportunity" for "transformative resilience" of spa offers instigated by the pandemic as argued by Rančić Demir et al. (2022). Slovenia and Croatia were found to be in-between medical spas and wellness, closest to what has been previously stated as "medical wellness" (EuropeSpa, 2022).

The practical implications of the study were mostly of interest to destination managers and marketers. The destination should monitor changes on the demand side, and provide services and experience according to the identified trends. It is an evident process of "spaization" (Smith & Puczko, 2010), with a balanced approach of spas that combine both medical and wellness aspects. This mixture was more pronounced with the outbreak of a pandemic, as the health crisis has highlighted both the urge for wellness and prevention approach as much as it has been noted from a medical perspective based on recovery and rehabilitation. Study findings provide valuable insight into the recent spa tourism evolution, its response to the global health crisis and the projection of its growth in the near future.

The limitation of the study comes as a result of the non-inclusion of other destinations of the investigated region, particularly, neighboring countries of Romania and Bulgaria, and other countries from former Yugoslavia (Montenegro, North Macedonia and Bosnia and Herzegovina). Future research should consider the additional statistics categories, especially related to the distinction between domestic and international tourists.

Conflict of interests

The authors declare no conflict of interest.

References

1. Aluculesei, A. C., Nistoreanu, P., Avram, D., & Nistoreanu, B. G. (2021). Past and future trends in medical spas: A co-word analysis. *Sustainability*, *13*(17), 9646.
2. Antonelli, M., & Donelli, D. (2020). Respiratory rehabilitation for post-COVID19 patients in spa centres: first steps from theory to practice. *International Journal of Biometeorology*, *64*(10), 1811-1813.
3. Asadi, R., & Daryaei, M. (2011). Strategies for development of Iran health tourism. *Europian Journal of Social Science*, *23*(3), 329-44
4. Buzsik, K., Jonas-Berki, M., Köbli, A., & Palfi, A. (2015). Actual trends of health tourism in Hungary: the case of Hévíz. *Geographica Timisiensis*, *24*(2), 45-53.

5. Corbin, C.B., Lindsey, R., Welk, J.G., & Corbin, W.R. (2002). *Concepts of Fitness and Wellness*. New York: McGraw-Hill Companies.
6. Derco, J. (2020). Spa tourism in the Slovak Republic. *International Journal of Spa Wellness*, *3*, 187–197.
7. Dimitrovski, D., & Todorović, A. (2015). Clustering wellness tourists in a spa environment. *Tourism Management Perspectives*, *16*, 259–265.
8. Dini, M., & Pencarelli, T. (2021). Wellness tourism and the components of its offer system: a holistic perspective. *Tourism Review*, *70*(2), 394-412
9. Dillette, A.K., Douglas, A.C., & Andrzejewski, C. (2020). Dimensions of holistic wellness as a result of international wellness tourism experiences. *Current Issues in Tourism*, *24*, 794–810
10. Dryglas, D., & Różycki, P. (2017). Profile of tourists visiting European spa resorts: a case study of Poland. *Journal of Policy Research in Tourism, Leisure and Events*, *9*(3), 298–317.
11. EuropeSpa (n.d.). Medical Spa & Wellness. Retrieved from https://europespa.eu/medical-spa-wellness/medical-wellness/ (Accessed on 08 December 2022).
12. Garcia-Altes A. (2005). The development of health tourism services. *Annals of Tourism Research*, *32*, 262–275.
13. Global wellness summit.(2022), Global Wellness Trends Report 2022. Retrieved from https://www.globalwellnesssummit.com/2022-global-wellness-trends, (Accessed on 24 November 2022).
14. Hall, C. M. (2011). Health and medical tourism: A kill or cure for global public health? *Tourism Review*, *66*(1/2), 4–15
15. Huang, X., Zhang, Y., & Li, C. (2022). Assessing the Compensatory Potentiality of Hot Spring Tourism in the COVID-19 Post-Pandemic Environment. *Sustainability*, *14*(14), 8579.
16. Jakubíková, D., Vildová, E.. Janecek, P.. & Tluchor, J. (2019). *Lázenství, Management a Marketing*. [*Medical Spa, Management and Marketing*]. Grada Publishing: Prague, Czechia.
17. Kiss, K. (2015). The challenges of developing health tourism in the Balkans. *Tourism: An International Interdisciplinary Journal*, *63*(1), 97–110
18. Lakićević, M., Pantović, D., & Fedajev, A. (2023). Investigating Factors of Customer Loyalty Formation for Wellness Spa. Management: *Journal Of Sustainable Business And Management Solutions In Emerging Economies*, . doi:10.7595/management.fon.2021.0031
19. Martínez-Moure, O., & Saz-Peiró, P. (2021). The role of spas during the COVID-19 crisis. *Medicina Naturista*, 61–68.
20. Majeed, S., & Kim, W. G. (2022). Emerging trends in wellness tourism: a scoping review. *Journal of Hospitality and Tourism Insights*, (ahead-of-print). https://doi.org/10.1108/JHTI-02-2022-0046
21. Manna, R., Cavallone, M., Ciasullo, M. V., & Palumbo, R. (2020). Beyond the rhetoric of health tourism: shedding light on the reality of health tourism in Italy. *Current Issues in Tourism*, *23*(14), 1805–1819.

22. Mueller, H., & Kaufmann, E. L. (2001). Wellness tourism: Market analysis of a special health tourism segment and implications for the hotel industry. *Journal of Vacation Marketing*, 7(1), 5–17.
23. Paunović, I. (2013). Proposal for Serbian tourism destinations marketing campaign. *The European Journal of Applied Economics*, *10*(2), 40–52.
24. Pinos Navarrete, A., & Shaw, G. (2021). Spa tourism opportunities as strategic sector in aiding recovery from Covid-19: The Spanish model. *Tourism and Hospitality Research*, *21*(2), 245–250.
25. Pessot, E., Spoladore, D., Zangiacomi, A., & Sacco, M. (2021). Natural resources in health tourism: A systematic literature review. *Sustainability*, 13(5), 2661.
26. Rodrigues H, Brochado A, Troilo M, Mohsin A. (2017). Mirror, mirror on the wall, who's the fairest of them all? A critical content analysis on medical tourism. *Tourism Management Perspective*, 24, 16–25.
27. Rodrigues, H., Brochado, A., Troilo, M., & Mohsin, A. (2022). Wellness comes in salty water: thalassotherapy spas and service level of satisfaction. *International Journal of Spa and Wellness*, 5(1), 71–90.
28. Rančić Demir, M., Pavlakovič, B., Pozvek, N., & Turnšek, M. (2022). Adapting the wellness offer in Slovenian spas to the new COVID-19 pandemic conditions. *International Journal of Spa and Wellness*, *5*(3), 285–297.
29. Rodrıguez Miguez L (2010). El termalismo en Galicia de cara al siglo XXI. In: Presentacion de la Ca´tedra de Hidrologıa Medica. Galicia: USC–Balnearios de Galicia.
30. Sarker, M., Kasem, N., Wong, B. K. M., & Moghavvemi, S. (2022). Conceptualizing essential components affecting health tourism satisfaction in Asia: does context matter? *Journal of Quality Assurance in Hospitality & Tourism*, *23*(5), 1107–1135.
31. Szromek, A. R., & Naramski, M. (2019). A business model in Spa tourism enterprises: A case study from Poland. *Sustainability*, 11(10), 2880
32. Smith, M. K., & Dryglas, D. (2020). Editorial for the special issue of international journal of Spa and wellness challenges for the Spa sector: Transitioning from medical to wellness services. *International Journal of Spa and Wellness*, *3*(2-3), 67–68.
33. Smith, M. & Kelly, C. (2006). Wellness Tourism. *Tourism Recreation Research*, *31*(1),1–4
34. Smith, M. K., & Puczkó, L. (2013). *Health, tourism and hospitality: Spas, wellness and medical travel*. London: Routledge
35. Smith, M. and Puczkó, L. (2009). *Health and wellness tourism*. United Kingdom: Butterworth-Heinemann
36. Smith, M., & Puczkó, L. (2015). More than a special interest: Defining and determining the demand for health tourism. *Tourism Recreation Research*, *40*(2), 205–219.
37. Surugiu, C., Surugiu, M. R., & Mazilescu, R. (2021). Social insurance system influence on spa tourism: Evidence for Romania. *Anatolia*, *32*(1), 59–69.

38. Sziva, I., Balázs, O., Michalkó, G., Kiss, K., Puczkó, L., Smith, M., & Apró, E. (2017). Branding strategy of the countries in the Balkan region-focusing on health tourism. *GeoJournal of Tourism and Geosites*, *19*(1), 61–69.
39. Tomka, D., Holodkov, V., & Andjelković, I. (2015). Quality of Life As a Travel Motivational Factors of Senior Tourists - Results of Research in Novi Sad. *Informatologia*, 48(1–2), 62–70.
40. Travis, A. (2011). Resorts Are Not Forever. In Planning for Tourism, Leisure and Sustainability: International Case Studies; CABI: Birmingham, UK, pp. 279–286.
41. Unković, S. & Zečević B. (2000). *Ekonomika turizma*. Beograd: Ekonomski fakultet.
42. Varga, C. (2019). To treat or not to treat? Misbeliefs in spa water disinfection. *International Journal of Biometeorology*, 63(8), 1135–1138.
43. Vujadinović, D. (2004). Democratic Deficits in the Western Balkans and Perspectives on European Integration. *Journal for Institutional Innovation, Development & Transition*, 8.
44. Yuan Z, Zhu Z, Yang H, Yu L, Chen G. (2017). On development strategies of TCM health tourism. In: 2017 international conference on economic development and education management (ICEDEM 2017). Atlantis Press; December
45. Yoo, I. Y., Lee, T. J., & Lee, C.-K. (2015). Effect of Health and Wellness Values on Festival Visit Motivation. *Asia Pacific Journal of Tourism Research*, *20*(2), 152–170
46. World Tourism Organization – UNWTO (2021). *World Tourism Barometer and Statistical Annex*, Retrieved from https://www.e-unwto.org/doi/abs/10.18111/wtobarometereng.2021.19.1.1 (Accessed on 29 November, 2022).
47. World Spa Organization (n.d). *About us. History. Spa industry today*. Retrieved from https://www.worldspaorganization.com/about/history/ (Accessed on 01 December 2022).

MANAGING EMPLOYEE PERFORMANCE IN THE AGRICULTURAL SECTOR: IMPORTANCE OF HUMAN CAPITAL DEVELOPMENT

Jasmina Ognjanović[1], Marko Slavković[2], Marijana Bugarčić[3]

**Corresponding author E-mail: jasmina.lukic@kg.ac.rs*

ARTICLE INFO

Original Article

Received: *03 February 2023*

Accepted: *14 March 2023*

doi:10.59267/ekoPolj2301237O

UDC 005.96:338.46

Keywords:

human capital, the efficiency of human capital, agriculture sector, employee performance

***JEL**: J24, D24, L25*

ABSTRACT

Contemporary business conditions, the global food crisis, and the post-epidemic recession have led agricultural firms to reconsider human capital's role in the overall business. Previous research points to the problem of low efficiency in the use of resources in the agricultural sector when it comes to investment and development of human capital. The aim of the study is to analyze the contribution of human capital to employee performance in agricultural firms in Serbia. Human capital is observed through human capital efficiency (HCE). Employee performance is observed through value-added per employee, net profit per employee, operating revenue per employee, and labor productivity. VAIC methodology for calculating HCE was applied in the paper. The sample includes 177 active agricultural firms that operated in Serbia in 2021. Based on the results, it can be concluded that HCE positively contributes to the observed employee performance, except in the case of value-added per employee.

Introduction

In the conditions of rapid population growth and post-epidemic recession, the agricultural sector is becoming an increasingly important economic branch at the global level, since the global food crisis is becoming increasingly apparent. Due to the increasing role of human resources in agriculture, as well as the efforts of firms to improve operations and respond to the challenges of global competition, agricultural firms should take care of

1 Jasmina Ognjanović, Ph.D., Assistant professor, University of Kragujevac, Faculty of Hotel Management and Tourism in Vrnjačka Banja, Vojvođanska 5A, 36210 Vrnjačka Banja, Serbia, Email: jasmina.lukic@kg.ac.rs, ORCID ID: (https://orcid.org/0000-0002-6036-5269)

2 Marko Slavković, Ph.D., Associate professor, University of Kragujevac, Faculty of Economics, Liceja Kneževine Srbije 3, 34000 Kragujevac, Serbia, Email: mslavkovic@kg.ac.rs, ORCID ID: (https://orcid.org/0000-0002-2604-1228)

3 Marijana Bugarčić, Ph.D., Teaching Assistant, University of Kragujevac, Faculty of Economics, Liceja Kneževine Srbije 3, 34000 Kragujevac, Serbia, Email: msimic@kg.ac.rs, ORCID ID: (https://orcid.org/0000-0001-7343-801X)

regular investment in education and expertise, and the development of employees in order to acquire modern knowledge and competences (Dimovski et al., 2022). The need for additional investment in human resources of agricultural firms becomes justified, taking into account scarce natural resources as well as demographic and technological changes (Dimovski et al., 2022). Bearing in mind the stated reasons for investing in the human capital of agricultural firms, the authors of Hadelan et al. (2022) emphasize that agricultural firms provide a significant contribution to employability and job creation, thus contributing to local rural employment and providing a social, cultural and environmental contribution to the sustainability of rural areas.

The agricultural sector in Serbia resisted the challenges of the political and economic crisis, continuously contributing to the good economic results of the country (Žarevac Bošković et al., 2022; Dimovski et al., 2022). Improving the competence of human resources is particularly important in order for the agricultural sector of Serbia to increase its participation in the international market, especially the EU market (Dimovski et al., 2022). Based on STAT.YEARB.SERB data (2022), employment in the agriculture, forestry, and fishing sector in Serbia shows a tendency to decrease from 2019 to 2021. Based on the same source, it can be concluded that the number of employees in 2021 compared to 2011 decreased by 14%. The average net salary in 2021 increased by 7.04% (STAT.YEARB.SERB. 2022:87). The sector of agriculture, forestry, and fishing participated with 6.3% in the value of the gross domestic product, which is a 0.3% higher share compared to 2019 (STAT.YEARB.SERB. 2022:147).

One of the factors that influence the development of agricultural firms are effective human resources policies (Ryazanova, 2019). Investing in the development of human capital increases the value of knowledge workers and their productivity (Pulić, 2004). However, research shows that the majority of women and men who work in agricultural firms have very little education (Gupta et al., 2023). In addition, human capital programs in the small business sector have traditionally been viewed as quite expensive, which limits their use (Klaas et al., 2010). Liu et al. (2022) emphasize as a special problem of the agricultural sector is that agricultural production struggles with the low efficiency of the used resources. Therefore, the aim of the study is to analyze the contribution of human capital to employee performance in agricultural firms in Serbia. Human capital will be analyzed through human capital efficiency (HCE).

A review of the literature revealed a couple of research gaps. First, most studies analyze the macro-production environment of agricultural firms (Liu et al., 2022) and do not deal with the micro factors and resources used within the firm. The authors of Gupta et al. (2023) note that academic research about agri-food systems often ignores what happens between the farm and the final consumer and focuses too much on consumers. Therefore, there is a need to analyze the role of human capital, as a micro factor of business, in agricultural firms. Second, previous studies analyzed the importance of human capital in the agricultural sector through effective human resources policies (Ryazanova, 2019); training and development of employees (Pansuwong et al., 2023); formal and informal education (Dimovski et al., 2022). However, previous studies did

not analyze the efficiency of the use of human capital through HCE in the agricultural sector. By analyzing HCE firms monitor how capable they are of creating value through the efficient use of human capital (Pulić, 2004). Third, previous studies have analyzed the relationship between human capital and the competitiveness of agricultural firms (Dimovski et al., 2022); human capital and growth of firms (Pansy Wong et al., 2023); human resource management and motivation in agriculture (Ilic et al., 2022). Vukoje et al. (2022) consider that future research should be based on the analysis of the financial performance of agricultural firms and farms, as well as the analysis of available capacities as the main drivers of the agricultural sector. Bearing in mind the observed research gaps, this study focuses on the analysis of HCE in agricultural firms and its impact on employee results i.e. employee performance.

According to the observed problem of the agricultural sector as well as observed research gaps, the study aims to answer the following research questions:

1. How efficiently do agricultural firms in Serbia use available human capital?

2. Is there an impact of HCE on employee performance in agricultural firms?

Literature review

The role of human capital in agricultural firms

Human capital represents the value of accumulated knowledge and skills of employees, which are significant for the success and survival of the firm (Pansuwong et al., 2023). Nguyen-Anh et al. (2022) consider human capital as a profitable input that indicates a firm's ability to acquire new information, skills, and technology. Modern business conditions and the demands of the competitive environment lead to the fact that workers in agricultural firms must continuously acquire new knowledge, skills, and abilities in order to respond to greater market demand and keep up with the development of technology and science (Dimovski et al., 2022). Numerous theoretical and practical studies classify human capital as the main driving forces and key determinants of the competitiveness of agricultural firms that contribute to the improvement of business through the continuous acquisition of knowledge and skills of employees in these firms (Nguyen-Anh et al., 2022; Dimovski et al., 2022). For this reason, it can be said that the development of human capital can guarantee the sustainability and stability of agriculture firms in unstable environmental conditions. Investing in human capital helps these firms to outperform competitors, quickly take on new tasks, and perform various innovative jobs (Nguyen-Anh et al., 2022) through the exchange of knowledge between employees and coordination of all management levels of the hierarchy (Ryazanova, 2019).

The importance of human capital for agricultural firms can be explained on the basis of the theory of human capital and the resource-based view. According to human capital theory, individuals possess skills, abilities, and knowledge that provide economic value to an firm (Slavković, Ognjanović, 2018). The same theory suggests that management's

decision to invest in human capital is based on monitoring and comparing potential future benefits with the cost of human capital (Ming Chen, Jun Lin, 2004). Another theoretical approach that supports the development of human capital in agricultural firms is the resource-based view, according to which key skills essential for competitive advantage can be acquired from internal development, within the firm itself, in this case, employees (Ming Chen, Jun Lin, 2004).

Garavan et al. (2001) believe that investing in the development of human resources is necessary for several reasons: to build and maintain human resources in the future and to keep those resources in the present. The same authors state four key attributes of human capital that must be considered when managing this capital: flexibility and adaptability, improvement of individual competencies, development of organizational competencies, and individual employability (Garavan et al., 2001). Slavković and Ognjanović (2018) point out that a particularly important characteristic of human capital is that it is not owned by the firm, since the knowledge, skills, and know-how of employees can not be separated from the individual. Therefore, leaving the firm, temporarily or permanently, implies that the firm remains without a part of its human capital (Slavković, Ognjanović, 2018).

Research shows that the use of human capital affects the efficiency of the firm (Nkambule et al., 2022). Rahimpour et al. (2020) point out that with the help of human capital, an firm can increase the efficiency and effectiveness of the use of all other resources and thus the competitive advantage of agricultural firms. Xia et al. (2020) believe that the increase in the number of employees is one of the key factors affecting the utilization and protection of agricultural land. Literature proves that human capital is one of the key factors in the profitability of agricultural firms (Gloy et al., 2002; Ming Chen, Jun Lin, 2004; Vukoje et al., 2022; Buallay, 2022). Bearing in mind the mentioned benefits of the use of human capital as well as its impact on the profitability of agricultural firms, there is a need to analyze the efficiency of its use and its impact on the results of agricultural firms.

Human capital and employee performance

Employees are a significant asset of any firm whose business success or failure can be attributed to the employees' performance (Rahimpour et al., 2020). Employee performance represents the results of employees' work, that is, the level of efficiency and effectiveness that employees achieve while performing assigned activities and tasks (Ahmad et al., 2015). By analyzing the employee performance management of agricultural firms, it monitors the overall efficiency and productivity of organizational processes, the results of employees at the level of each functional unit, and also the results at the organizational level (Ahmad et al., 2015). Employee performance is the result of the behavior and attitudes of the employees, their commitment and understanding of the assigned tasks, as well as adherence to the standards they need to meet (Silva et al., 2022).

The approach of employees to the performance of business tasks affects their work

results as well as overall business results. Employee performance depends on the efficiency of the use of available resources by employees. Effective performance of business tasks is conditioned by investment in human capital, i.e. in the knowledge, skills and abilities of employees. For this reason, it is necessary to look at how efficiently agricultural firms use human capital (HCE) and how this efficiency is reflected in the level of employee performance.

Labor productivity is often used as an indicator of employee performance in the literature. Productivity is mainly determined by the level of production factors in the country (land, capital, natural and human resources) but also by the efficiency of their use (Dimovski et al., 2022). Productivity growth in agricultural firms can be increased by strengthening production capacities or by improving the technical equipment of agricultural holdings (Hadelan et al., 2022), as well as formal environmental regulations and environmental non-governmental organizations (Liu et al., 2022). Rada and Fuglie (2019) link the level of productivity and the size of the farm, where they conclude that higher productivity is achieved on a smaller farm. Improvement of productivity and more efficient use of resources in agricultural firms can be achieved through the training and development of employees, as shown in previous studies (Yang, Chen, 2019; Pansuwong et al., 2023). Through the training and development of employees, their motivation is increased, productivity and profits are increased, but it also absorbs more workforce by increasing investment in human capital and improving the labor proficiency of employees (Yang, Chen, 2019). In previous studies, other indicators of employee performance (value-added per employee, net profit per employee, operating revenue per employee) were not the subject of analysis. Given that previous studies indicate the importance of improving productivity for the business of agricultural firms, it is necessary to investigate the influence of the efficiency of the use of human capital on other employee performance. The following research hypotheses were established:

H_1: Human capital efficiency contributes to value-added per employee in agricultural firms.

H_2: Human capital efficiency contributes to net profit per employee in agricultural firms.

H_3: Human capital efficiency contributes to operating revenue per employee in agricultural firms.

H_4: Human capital efficiency contributes to labor productivity in agricultural firms.

Materials and methods

Sample and data collection

Analysis of the relationship between HCE and employee performance using a sample of active firms in the Serbian agriculture sector. The necessary data on active agricultural firms were collected on the basis of the database available on the website of the Ministry of Finance of the Republic of Serbia, Treasury Administration. Podaci za obračun nezavisne i zavisnih varijabli prikupljeni su iz baze Serbian Business Registers Agency.

From the total number of active firms, those for which no financial data were available were eliminated. The sample was reduced to 177 agricultural firms, and financial data were collected for the year 2021. The structure of the observed sample is given in Table 1.

Table 1. Sample descriptives

The legal form of the firms	**Number**	**%**
Agricultural cooperative	50	28.2
Entrepreneur	4	2.3
A limited liability company	116	65.5
Stock company	6	3.4
Limited partnership	1	0.6
Σ	**177**	**100**
Firms size	**Number**	**%**
Micro	101	57.1
Small	47	26.6
Medium	24	13.6
A large firms	5	2.8
Σ	**177**	**100**
Number of employees	**Number**	**%**
up to 9 employees	110	62.1
10-49	43	24.3
50 – 149	19	10.7
150 and more	5	2.8
Σ	**177**	**100**

Source: Author's calculation

The sample is dominated by agricultural firms of the legal form Limited Liability Company (65.5%), and micro-sized firms (57.1%) that employ up to 9 workers (62.1%).

Methodology

By applying the VAIC methodology, the value of HCE is calculated, which indicates how efficiently the firm uses human resources. Firms aim to increase the effective utilization of human capital because this will ensure higher value creation for the firm (Hasnaoui, Hasnaoui, 2022). The VAIC methodology was established by Pulić (2004). The methodology is based on the calculation of value-added, as an objective indicator of business success, and shows the firm's ability to create value on the basis of „the investment in resources including salaries and interests on financial assets, dividends to the investors, taxes to the state and investment in future development" (Pulić, 2004:64). Value added can be calculated as follows (Pulić, 2004):

$$VA = OP+EC+D+A \quad (1)$$

OP = Operating; EC = Employee costs; D = Depreciation; A = Amortization.

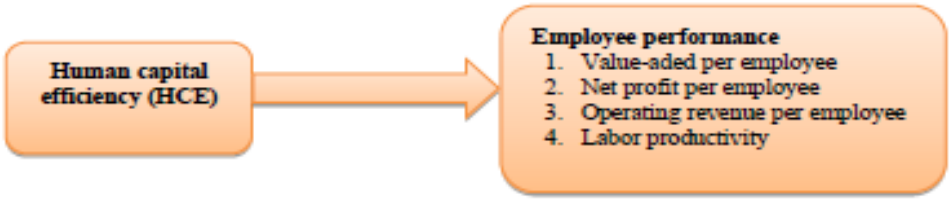
Human capital efficiency is calculated as follows (Pulić, 2004):

$$HCE = VA/HC \quad (2)$$

HCE = Human capital efficiency; VA = Value added and HC = total salaries and wages of the firm.

The research model is shown in Figure 1. The independent variable is HCE. The values for calculating HCE are taken from the financial reports of observed agricultural firms. Financial reports are available in the database of the Serbian Business Registers Agency.

Figure 1. Research model



Source: Authors

The advantages of using the VAIC methodology are reflected in the available quantitative data for the calculation of HCE in financial statements that are public. Second, VAIC methodology provides a standardized and consistent measure, given that it does not use subjective measures obtained from questionnaires. Thirdly, the calculation of the HCE coefficient is suitable for comparison with previous years, but also between firms from the same or different economic activities (Bayraktaroglu et al., 2019).

The dependent variables in the paper are:

Value added per employee shows the added value created by one employee. It is calculated by dividing the value-added value and the number of employees in agricultural firms (Bontis et al., 2018; Ognjanović, Pešterac, 2019).

Net profit per employee shows how much net profit value is created per employee. It represents the ratio of net profit value and the total number of employees (Chen et al., 2008; Ni et al., 2021).

Operating revenue per employee shows the value of operating revenue created by one employee. It is calculated as a ratio of operating revenue value and the total number of employees (Ni et al., 2021).

Labor productivity represents the ratio of profit before tax to the number of employees (Ognjanović, Slavković, 2022). It indicates the contribution of each employee to the creation of profit before tax.

Statistical methods

Data processing and testing of research hypotheses was performed using the statistical package for social sciences IBM SPSS Statistics, Version 23. A confidence interval ά = 0.05 was used to determine statistical significance. The paper uses descriptive statistics, correlation analysis and regression analysis in order to test research hypotheses.

Results

Descriptive statistics

Using descriptive analysis, the mean of observed variables, standard deviation, kurtosis, and skewness for observed variables are determined (Tabela 2). The mean value of HCE for observed agricultural firms is 7.64. If the dependent variables are observed, Operating profit per employee has the highest mean 848.62. The standard deviation records the highest value in the case of Labor productivity. By looking at the kurtosis values for all variables, it can be concluded that they are positive, which means that the distribution is sharper than normal. By looking at the skewness values, it can be concluded that the values of HCE, Value added per employee, and Operating revenue per employee are positioned to the left of the arithmetic mean, i.e. closer to lower values. In the case of the variables Net profit per employee and Labor productivity, most values are positioned closer to higher values.

Table 2. Descriptive statistics

Variables	Mean	St. Deviation	Kurtosis		Skewness	
			Statistics	St. Error	Statistics	St. Error
HCE	7.64	43.25	153.63	0.36	12.06	0.18
Value added per employee	34.24	122.19	59.03	0.36	7.35	0.18
Net profit per employee	379.35	3284.51	19.49	0.36	-0.82	0.18
Operating revenue per employee	848.62	3311.06	23.80	0.36	3.69	0.18
Labor productivity	498.34	3478.89	19.47	0.36	-0.12	0.18

Source: Author's calculation

Testing research hypotheses involves determining the normality of the distribution. As the observed sample includes 177 agricultural firms, the Kolmogorov-Smirnov test is used to check the normality of the distribution. based on the value of this test, it can be concluded that the normality of the distribution has not been proven, since for all observed variables the Kolmogorov-Smirnov test > 0.05.

Correlation analysis

Correlation analysis is carried out using Spearman's rho coefficient, whose value indicates the direction and strength of the relationship between the observed variables. The strength of the correlation is determined by the value of the correlation coefficient. Values of this coefficient from 0.10 to 0.29 indicate weekly correlation, values from 0.30 to 0.49 indicate moderately correlation, while values greater than 0.50 indicate strong correlation between variables (Pallant, 2016). Depending on whether Spearman's rho coefficient has a positive or negative value, the direction of the correlation is determined. The results of the correlation analysis are shown in Table 3.

Table 3. Correlation analysis

Variables	HCE	Value added per employee	Net profit per employee	Operating revenue per employee	Labor productivity
HCE	1				
Value added per employee	0.118	1			
Net profit per employee	0.688**	0.189*	1		
Operating revenue per employee	0.837**	0.217**	0.810**	1	
Labor productivity	0.702**	0.184*	0.996**	0.825**	1
** Correlation is statistically significant on the level of 0.050* *** Correlation is statistically significant on the level of 0.000*					

Source: Author's research

Looking at Table 3, HCE achieves a positive, strong, and statistically significant correlation with employee performance, except in the case of value-added per employee. The strongest correlation is present between HCE and operating revenue per employee ($\rho = 0.837$; $p = 0.000$). If the correlation between the dependent variables is observed, the strongest correlation is between labor productivity and net profit per employee ($\rho = 0.996$; $p = 0.000$), while the weakest correlation was identified between value-added per employee and labor productivity ($\rho = 0.184$; $p = 0.012$). Otherwise, the variable value-added per employee leaves a weak but statistically significant correlation with other employee performance.

Regression analysis

The impact of HCE on employee performance is determined using a simple regression analysis. The application of this analysis implies the fulfillment of certain assumptions: multicollinearity and autocorrelation. Multicollinearity indicates a high degree of correlation between variables. A high value of multicollinearity hinders the implementation of regression analysis. That is why the recommended value of the VIF coefficient (which monitors multicollinearity) is up to 10 (Field, 2009). Autocorrelation is monitored based on the Durbin-Watson coefficient. If the value of this coefficient is < 4, the regression analysis is justified. All observed models met the minimum conditions of multicollinearity and autocorrelation.

Model 1 analyzes the relationship between HCE and value-added per employee. Based on the data shown in Table 4, it can be concluded that hypothesis **H_1 is rejected** ($p = 0.662$), i.e. HCE does not contribute to value-added per employee. The coefficient of determination R^2 is 0.033, which means that 3.3% of the variability of value-added per employee is explained by the regression model, while the rest is influenced by other factors.

Table 4. Model 1 – HCE and Value-added per employee

Variables		Standard regression model		
Dependent	**Independent**	**β**	**t-value**	**Sig.**
Value-added per employee	HCE	-0.033	-0.438	0.662
Dependent variables: Value-added per employee *Significant: ** p ≤ 0.01; * p ≤ 0.05* *DW =2.008* *R^2 = 0.033* *F = 0.192* *p = 0.662*				

Source: Author's calculation

Model 2 analyzes the relationship between HCE and Net profit per employee. The information in Table 5 shows that HCE contributes positively to net profit per employee, that is, hypothesis **H_2 is accepted** (p = 0.000). The coefficient of determination R^2 is 0.234, which means that 23.4% of the variability of net profit per employee is explained by the regression model, while the rest is influenced by other factors. The value of Adjusted R Square is 0.230. The value of the β coefficient is 0.484, which means that an increase in HCE by 1 unit of standard deviation leads to an increase in net profit per employee by 0.484 units of standard deviation.

Table 5. Model 2 – HCE and Net profit per employee

Variables		Standard regression model		
Dependent	**Independent**	**β**	**t-value**	**Sig.**
Net profit per employee	HCE	0.484	7.319	0.000
Dependent variables: Net profit per employee *Significant: ** p ≤ 0.01; * p ≤ 0.05* *DW =2.033* *R^2 = 0.234* *F = 53.568* *p = 0.00*				

Source: Author's calculation

Hypothesis H_3 is accepted, that is, HCE contributes positively to operating revenue per employee (p = 0.000).

Tabela 6. Model 3 – HCE and Operating revenue per employee

Variables		Standard regression model		
Dependent	**Independent**	**β**	**t-value**	**Sig.**
Operating revenue per employee	HCE	0.518	8.011	0.000
Dependent variables: Operating revenue per employee *Significant: ** p ≤ 0.01; * p ≤ 0.05* *DW =2.101* *R^2 = 0.264* *F = 64.170* *p = 0.00*				

Source: Author's calculation

Based on the value of the coefficient of determination R^2, it can be concluded that 26.4% of the variability of operating revenue per employee is explained by the regression model, while the rest is influenced by other factors. Growth of HCE by 1 unit of standard deviation leads to growth of operating revenue per employee by 0.518 units of standard deviation.

Table 7. Model 4 – HCE and Labor productivity

Variables		Standard regression model		
Dependent	**Independent**	**β**	**t-value**	**Sig.**
Labor productivity	HCE	0.528	8.233	0.000
Dependent variables: Labour productivity *Significant: ** $p \leq 0.01$; * $p \leq 0.05$* *DW =2.034* *$R^2 = 0.279$* *F = 67.790* *p = 0.00*				

Source: Author's calculation

The results of Model 4 show that HCE has a positive effect on labor productivity, that is, hypothesis **H_4 is accepted** (p = 0.000) (Table 7). The coefficient of determination R^2 is 0.279, while the value of Adjusted R Square is 0.275. The value of the β coefficient is 0.528, which means that an increase in HCE by 1 unit of standard deviation leads to an increase in labor productivity by 0.528 units of standard deviation.

Discussion and implication

The results of the study show that HCE contributes positively and statistically significantly to net profit per employee, operating profit per employee, and labor productivity. The impact of HCE on value-added per employee has not been proven. By testing the research hypotheses, answers to the research questions were found. First, based on the results of descriptive statistics and regression analysis, it can be concluded that agricultural firms use their human capital efficiently. This means that the observed agricultural firms achieve a higher marginal revenue from investment in human resources development compared to the marginal cost (Buallay et al., 2021). Additional improvement in efficiency can be achieved by investing in modern technology and material equipment. Second, the impact of HCE was confirmed on the observed employee performance of agricultural firms, except in the case of value added per employee. The increase in the efficiency of the use of human capital leads to the improvement of the results of the employees' work. On the other hand, the relatively high return on human capital in rural non-farm business firms becomes attractive for individuals who are considering returning to the countryside and becoming entrepreneurs (Liu, 2011).

The importance of human capital in creating the satisfactory performance of agricultural firms was proven by the authors (Gloy et al., 2002; Ming Chen, Jun Lin, 2004; Vukoje et al., 2022). High productivity and results of employees' work are achieved by the best

use of employees' abilities and on the basis of achieving cost efficiency (Ognjanović et al., 2022). Kengatharan (2019) concludes that employees with significant human capital contribute to a high level of productivity through reduced input and increased use of resources, which affects lower production costs. Such results are in line with the theory of human capital and resource-based view, according to which investment in human resources leads to the creation of economic value for the firm and the acquisition of a sustainable competitive advantage. The strategy of developing and using human capital can be considered one of the most important strategies that a firm follows in order to achieve success. For the above reasons, the costs incurred by investing in human capital should be viewed as inputs, while the creative ideas of employees are outputs, i.e. returns on investments (Mansour et al., 2014).

Modern business conditions lead to human capital becoming the dominant resource for creating satisfactory business results through satisfactory employee performance, even in traditional industries such as agriculture. High-quality human capital leads to solving business problems and bottlenecks that ensure production efficiency and thus increase organizational efficiency (Kengatharan, 2019). Therefore, in agricultural firms with superior human capital, employees perform various tasks in a more creative way, show appropriate behavior at the workplace, perform business tasks efficiently and go the extra mile beyond the roles specified in the job description (Kengatharan, 2019).

Improving the efficiency of the use of human capital as well as the performance of agricultural firms can be achieved through various human resource management practices. Ahmad et al. (2015) recommend that the growth of employee performance can be achieved by investing in monetary benefits, training programs, non-monetary benefits, organizational support, organizational support for career development, supervisory support, and capacity-building programs. Liu et al. (2022) consider that high-quality human capital can promote and encourage R&D in green technologies, provide technical and knowledge support for activities and management of agricultural land, and is therefore an essential source of economic growth for agricultural firms. The research results are consistent with the conclusion (Mehreen, Ali, 2022) that improving employee performance requires the promotion of a learning and development culture in order to achieve sustainable competitive advantage.

Practical implication

The results of the research indicate that the efficiency of the use of human capital affects the observed employee performance, except for value added per employee in agricultural firms in Serbia. Considering the level of development of the agricultural sector in Serbia, farm managers and owners would have to invest more funds in equipment and physical assets in order to improve the efficiency of the use of human capital. Human capital gains value by using the knowledge, skills, and abilities of employees over equipment and other material and financial assets. By using modern equipment, the efficiency of the use of human capital would increase, and thus the results of the employees' work would be at a higher level, which would increase the value-added per employee.

The drop in employment in the agricultural sector of Serbia was highlighted as a special research problem. This result is partly a consequence of the introduction of modern technologies, but it is also a consequence of worse working conditions. That is why farm owners must create better conditions for the work of employees, first of all by introducing modern equipment, so that employment grows and thus the volume of business. In addition to technical equipment, owners must also take care of providing various types of benefits to employees in order to improve the image of the business. By recognizing the agricultural sector as an attractive branch of the economy on the labor market, agricultural firms will direct further business development and enter new markets, since the need for food is constantly growing at the global level.

Owners must look at the reason for poor value added per employee results. The reason for such results can be insufficient innovative practices as well as a lack of creative ideas in the business of these firms. Innovation can be achieved in all fields, from business organization to the communication and delivery of agricultural products to the consumer. Therefore, farm owners should provide such working conditions that will encourage employees to innovate in all areas of business and support them in more creative work.

Limitation of research

The first limitation is of a methodological nature and refers to the HCE calculation procedure. Salaries of employees, compensation for employees, taxes, and contributions are shown as the only cost, i.e. investment in human capital. The financial reports do not specifically show items related to investment in employee training, training, non-material rewards, etc. Therefore, it appears that part of the value of human capital is not reported, resulting in an underreported HCE value compared to the real one. However, for all observed firms, the income statement did not show additional investments in human capital, so for all firms, HCE was calculated according to the same criteria.

The second limitation refers to the availability of data. Financial reports were not available for a certain number of agricultural firms, which limited the number of observed units in the sample. According to the data of the Ministry of Finance of the Republic of Serbia, Treasury Administration, the number of agricultural firms is 1200. The observed sample makes up 14.75% of the population.

The direction of future research

Future research could be based on the inclusion of additional variables of employee performance of agricultural firms as well as indicators of profitability, financial structure, and market performance. Also, it is possible to extend the analysis to other components of intellectual capital, applying the VAIC methodology. Future research could test the moderating influence of material assets on the relationship between HCE and the performance of agricultural firms. The idea for future researchers may be that it is necessary to investigate which benefits for employees contribute the most to the growth of employee performance.

Conflict of interest

The authors declare no conflict of interest.

References

1. Ahmad, T., Farrukh, F., & Nazir, S. (2015). Capacity building boost employees performance. *Industrial and Commercial Training*, *47*(2), 61-66.
2. Bayraktaroglu, A.E., Calisir, F., & Baskak, M. (2019). Intellectual capital and firm performance: an extended VAIC model. *Journal of Intellectual Capital*, *20*(3), 406-425.
3. Bontis, N., Ciambotti, M., Palazzi, F., & Sgro, F. (2018). Intellectual capital and financial performance in social cooperative firms. *Journal of Intellectual Capital*, 19(4), 712-731.https://doi.org/10.1108/JIC-03-2017-0049
4. Buallay, A. (2022). Sustainability reporting and agriculture industries' performance: worldwide evidence. *Journal of Agribusiness in Developing and Emerging Economies*, *12*(5), 769-790. https://doi.org/10.1108/JADEE-10-2020-0247
5. Chen, G., Firth, M., & Wei Zhang, W. (2008). The efficiency and profitability effects of China's modern firm restructuring programme. *Asian Review of Accounting*, *16*(1), 74-91. https://doi.org/10.1108/13217340810872481
6. Dimovski, J., Krstić, B., & Radivojević, V. (2022). Ensuring the improvement of agricultural competitiveness through the human resource development. *Economics of Agriculture*, *69*(4), 1017-1029.
7. Garavan, T.N., Morley, M., Gunnigle, P., & Collins, E. (2001). Human capital accumulation: the role of human resource development. *Journal of European Industrial Training*, *25*(2/3/4), 48-68.
8. Gloy, B.A., Hyde, J., & LaDue, E.L. (2002). Dairy farm management and long-term farm financial performance. *Agricultural and Resource Economics Review*, *31*(2), 233–247. https://doi.org/10.1017/S1068280500004032
9. Gupta, M., Kishore, A., Roy, D., & Saroj, S. (2023). Post-farmgate food businesses of India: The firms, the entrepreneurs, and the employees. *Global Food Security, 36*(2023). https://doi.org/10.1016/j.gfs.2022.100665
10. Hadelan, L., Zrilić, M., Jež Rogelj, M., & Zrakić Sušac, M. (2022). Enhancing the productivity of small farmers in croatia through the agricultural fund for rural development. *Economics of Agriculture*, *69*(4), 1043-1059.
11. Hasnaoui, J.A., & Hasnaoui, A. (2022). How does human capital efficiency impact credit risk?: the case of commercial banks in the GCC. *Journal of Risk Finance*, *23*(5), 639-651. https://doi.org/10.1108/JRF-04-2022-0083
12. Ilic, B., Djukic, G., & Nikolic, M. (2022). Rural tourism of eastern Serbia – human resources management and motivation. *Economics of Agriculture*, *69*(1), 241-255.
13. Kengatharan, N. (2019). A knowledge-based theory of the firm: Nexus of intellectual capital, productivity and firms' performance. *International Journal of Manpower*, *40*(6), 1056-1074. https://doi.org/10.1108/IJM-03-2018-0096

14. Klaas, B., Klimchak, M., Semadeni, M., & Holmes, J.J. (2010). The adoption of human capital services by small and medium firms: A diffusion of innovation perspective. *Journal of Business Venturing, 25*(2010), 349–360.
15. Liu, J. (2011). Human capital, migration and rural entrepreneurship in China. *Indian Growth and Development Review,* 4(2), 100-122. DOI: 10.1108/17538251111172023
16. Liu, Y., She, Y., Liu, S., & Lan, H. (2022). Supply-shock, demand-induced or superposition effect? The impacts of formal and informal environmental regulations on total factor productivity of Chinese agricultural firms. *Journal of Cleaner Production*, *380*, 135052, https://doi.org/10.1016/j.jclepro.2022.135052
17. Mansour, N., Gara, E., & Gaha, C. (2014). Getting inside the black box HR practices and firm performance within the Tunisian financial services industry. *Personnel Review, 43*(4), 490-514. 10.1108/PR-03-2013-0052
18. Mehreen, A., & Ali, Z. (2022). The interplay between employee development factors and succession planning in predicting employee performance: evidence from retail banks. *Industrial and Commercial Training*, *54*(3), 528-543. https://doi.org/10.1108/ICT-10-2021-0072
19. Ming Chen, H., & Jun Lin, K. (2004). The role of human capital cost in accounting. *Journal of Intellectual Capital*, *5*(1), 116-130. https://doi.org/10.1108/14691930410512950
20. Nguyen-Anh, T., Hoang-Duc, C., Nguyen-Thi-Thuy, L., Vu-Tien, V., Nguyen-Dinh, U., & To-The, N. (2022). Do intangible assets stimulate firm performance? Empirical evidence from Vietnamese agriculture, forestry and fishery small- and mediumsized firms. *Journal of Innovation & Knowledge, 7*(2022). https://doi.org/10.1016/j.jik.2022.100194
21. Ni, Y., Cheng, Y.-R., & Huang, P. (2021). Do intellectual capitals matter to firm value enhancement? Evidences from Taiwan. *Journal of Intellectual Capital*, *22*(4), 725-743. https://doi.org/10.1108/JIC-10-2019-0235
22. Nkambule, N.A., Wang, W.-K., Ting, I.W.K., & Lu, W.-M. (2022). Intellectual capital and firm efficiency of US multinational software firms. *Journal of Intellectual Capital*, *23*(6), 1404-1434. https://doi.org/10.1108/JIC-02-2021-0041
23. Ognjanović, J., & Slavković, M. (2022). Intellectual capital and financial performance of entrepreneurs in the hotel industry. *Hotel and Tourism Management*, *10*(1), 25–40. https://doi.org/10.5937/menhottur2201025O
24. Ognjanović, J., Mandarić, M., & Sekulić, D. (2022). Intellectual capital and productivity of managers: the case study of hotel industry in Serbia. *BizInfo (Blace) Journal of Economics, Management and Informatics*, *13*(1), 1–9. https://doi.org/10.5937/bizinfo2201001O
25. Ognjanović, J., & Pešterac, A. (2019). Research on the relationship between intellectual capital and indicators of work results of employees in the banking sector of the republic of Serbia. *School of Business*, *2*(2019), 1-22.
26. Pansuwong, W., Photchanachan, S. & Thechatakerng, P. (2023). Social innovation: relationships with social and human capitals, entrepreneurial competencies and growth of social firms in a developing country context. *Social Firm Journal,* DOI: 10.1108/SEJ-02-2022-0014

27. Pulic, A. (2004). Intellectual capital –does it create or destroy value? *Measuring Business Excellence*, *8*(1), 62–68. https://doi.org/10.1108/13683040410524757

28. Rada, N.E., & Fuglie, K.O. (2019). New perspectives on farm size and productivity. *Food Policy*, 84, 147-152.

29. Rahimpour, K., Shirouyehzad, H., Asadpour, M., & Karbasian, M. (2020). A PCA-DEA method for organizational performance evaluation based on intellectual capital and employee loyalty: A case study. *Journal of Modelling in Management*, *15*(4), 1479-1513. https://doi.org/10.1108/JM2-03-2019-0060

30. Ryazanova, G. (2019). Transformation of agricultural firms on the boundary of the XX-XXI centuries. IFAC PapersOnLine. *52*(25), 225–230.

31. Silva, P., Mota, J., & Moreira, A.C. (2022). Budget participation and employee performance in real estate companies: the mediating role of budget goal commitment, trust and job satisfaction. *Baltic Journal of Management*, ahead-of-print. https://doi.org/10.1108/BJM-03-2022-0118

32. Slavković, M., & Ognjanović, J. (2018). Impact of human capital on business performance of hotel firms in Serbia. *TEME*, *XLII*(4), 1339-1355.

33. STAT.YEARB.SERB. (2022). Statistical Yearbook of the Republic of Serbia. Statistical Office of the Republic of Serbia, Belgrade; https://publikacije.stat.gov.rs/G2022/Pdf/G20222055.pdf (January, 2023.)

34. Vukoje, V., Miljatović, A., & Tekić, D. (2022). Factors influencing farm profitability in the Republic of Serbia. *Economics of Agriculture*, *69*(4), 1031-1042.

35. Xia, M., Zhang, Y., Zhang, Z., Liu, J., Ou, W., & Zou, W. (2020). Modeling agricultural land use change in a rapid urbanizing town: Linking the decisions of government, peasant households and firms. Land Use Policy 90.

36. Yang, J., & Chen, H. (2019). Can rewards incentives of nonstate-owned firms realize co-win cooperation of workers, firms and the society? From the perspective of labor productivity, profit and labor absorption. *Nankai Business Review International*, *10*(2), 179-206. DOI:10.1108/NBRI-03-2018-0020

37. Žarevac Bošković, M., Lakićević, M. ., & Pantović, D. (2022). Rural tourism development in Rasina district. *Economics of Agriculture*, 69(2), 567–581. https://doi.org/10.5937/ekoPolj2202567Z

THE INFLUENCE OF ECONOMIC AND ENERGY CRISIS ON PRICE OF AGRICULTURAL PRODUCTS

Mirjana Dejanović[1]

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

ARTICLE INFO

Review Article

Received: *21 October 2022*

Accepted: *10 January 2022*

doi:10.59267/ekoPolj2301253D

UDC 338.57-026.23:63]:338.124.4

Keywords:

energetic crisis, economic crisis, agricultural production, sustainable agricultural economy, inflation, Serbia

***JEL**: P18,Q1Q43,Q18*

ABSTRACT

The purpose of this research is to explain the impact of the economic and energy crisis on the rise of prices of agricultural products and further development of a sustainable agricultural economy in Serbia. In the paper are used comparative data for analysis of the movement of agricultural production and inflation in the last 10 years. The evident result of the research is the great impact of the economic and energy crisis on the rise of prices of agricultural products and rising inflation. The main task of this research is to help to understand factors which are connected to the rise of prices of agricultural products, and to suggest adequate solutions for stopping inflation with the aim to obtain the supply of necessary foods in periods of crisis. In paper are recommended new strategies which will contribute to the proper treatment of agricultural production in the future and sustainable development.

Introduction

When the economy of the country or a specific part of the economy is facing economic problems, the only way to find adequate solutions is to take a good look at the external influences and the situation within its own economy.

In this paper, we are dealing with the influence of external factors, i.e. energy crisis, an economic crisis which is further complicated by the political situation in the world, on agricultural production, and prices of agricultural products. Why is that important? Because of world economic problems, the main goal of each country now is to provide a secure supply of energy and food, especially in the coming period of winter, where we can expect a special large consumption of energy. Due to the energy policy and the economic crisis, it is necessary to take a good look at all the effects that these factors have on the agricultural production of Serbia.

The purpose of this paper is to better understand all problems that agricultural production is faced with nowadays. First, what are the indicators that have an influence

1 Mirjana Dejanović, PhD, research associate at CIRNT, "Mihailo Pupin Institute", Volgina 15, 11000 Belgrade, Serbia, Phone: +381116773767, E-mail: mrmirjanadejanovic@gmail.com, ORCID ID (https://orcid.org/0000-0003-3369-331X)

on the rise of prices of agricultural products? Of course, the evidence is the effect of raising the cost of energy, the economic crisis in the world, imported inflation, climate conditions, prices of seeds, prices of plant protection products, price of insurance policies, supply and demand of agricultural products. We can see that there are a lot of factors which have an impact on agricultural production , and at first it looks like they act independently, but in the end they are all deeply connected.

Materials and methods

Method of analysis, synthesis and comparation of data was used for the tracking of the agricultural production, and specially production of main cereals, movement of prices, inflation and agricultural production as a whole in the last decades, and specially in last the last 4 years. The official data was used from Eurostat, World bank, Food and Agriculture Organization of the United Nations, and Statistical Office of the Republic of Serbia.

Results and discussion

The prices of agricultural products have increased dramatically, and this is mostly influenced by current events, the energy, economic, and political crisis in the world. These three crises are closely related to each other. There has been a drastic increase in the price of agricultural products caused primarily by the rise in energy prices, and then also in transport prices. This caused an increase in the price of most raw materials, and thus the final products. In addition to energy prices, the biggest problem is the increase in the prices of fertilizers, as well as products for plant protection.

The strategy of Serbia should be to ensure its own production of agricultural fertilizers and products for plant protection, and above all to focus on greater implementation of organic fertilizers wherever possible and stimulation of soil improvement through natural production of organic compost for smaller farms. With those resources, she can provide a secure supply to her own population.

Why is it good to focus on organic? Because it is healthy, because the prices of organic products are higher, because from the ecological point of view, we have a safe environment that is preserved, but also we provide sustainable development and secure the future life of future generations.

We must take into account not only the continuity and increase of agricultural production in Serbia, but also about the development of a sustainable agricultural economy. The world is facing the biggest challenges, which are not only a crisis in the supply of energy, but above all, in the production of a sufficient amount of food, which depends not only on energy, fertilizers, means of protection, but also with climates conditions and problems that have arise in the supply chain, given that transport has become very expensive.

There is a danger that there will be not just a food shortage, but also a decline in the quality of human nutrition. There is a danger that consumers due to the economic crisis, and higher prices, will use cheaper products of lower quality, with reduced quantity of purchased goods.

The negative impact of COVID is also very large because the countries were locked down and blocked for a long period because of health measures . The world was unprepared for a fast reaction to the global pandemic of COVID19, and that made an impact on economic trends and production. The COVID19 caused severe consequences, both for the health of people and its economies. It was a big shock even for the industries who very quickly transfer to remote work. Some sectors suffered great losses, while the pharmaceutical industry, manufacturers of drugs, and vaccines, has achieved a big increase in profit, and multiplied their wealth for several times. What happened to the production of main agricultural cereals very important for food ?

If we look at the statistical data, production of main cereals in the European Union will decrease in most cultures in 2020 compared with 2019. In the table below we can see a difference in production from year to year.

Table 1. Production of main cereals in EU

European Union						
Year	total yield in millions of tons					
	Wheat	Barley	Maize	Oats	Rye	Others
2010	112,4	47,8	59,4	6,8	7,7	30,0
2011	115,6	46,5	70,1	7,3	7,1	23,7
2012	112,3	49,5	59,0	7,3	9,0	26,8
2013	124,2	53,0	66,6	7,5	10,8	26,2
2014	132,7	53,9	77,3	7,0	9,3	27,8
2015	135,8	54,6	58,9	6,8	8,1	27,9
2016	120,5	53,5	62,7	7,4	7,6	28,3
2017	127,9	51,6	64,7	7,3	7,6	28,1
2018	115,6	50,1	69,0	6,9	6,5	25,9
2019	131,8	55,6	70,1	7,0	8,7	26,2
2020	119,1	54,7	67,8	8,5	9,5	26,9

Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agricultural_production_-_crops#Cereals, source data Crops, figures downloaded 15.10.2022 22:01

On the next chart we can see the highest value in production in 2014, and then really seriously falling down, especially in 2016. After a little recovery in 2017, we again have a fall in production in 2018, which is especially evident in wheat, and spelt production. Since 2014 till 2019 we have unstable production of wheat and spelt.

In a factors that contributed to a decrease in production in 2020 compared with 2019 we must also account the effect of COVID 19.After COVID 19 the economies of countries faced with inflation, and then to energetic crisis which was deepened by the introduction of sanctions against Russia by a large number of countries. The prices of fuel, gas, electric energy and other energy sources are raised.

That raise of energy prices has a multiplying effect on raises of all other prices , because at first raising the cost of transport causes an effect on prices, supply of resources, production and cost in wholesale and retail trade.

If we are faced with raising the prices of seeds, fertilizers, products for plant protection, price of insurance policies, and the lower production of agricultural products, on the other hand, it is very difficult to stop the further raising of inflation rates. There is a different types of inflation.

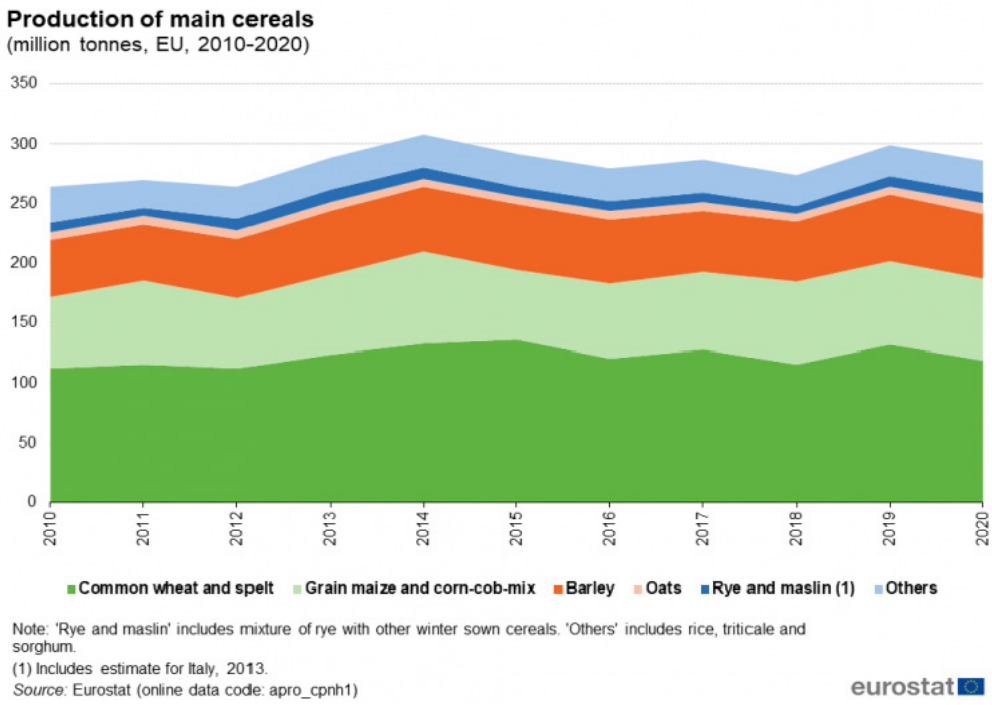
Figure 1. Inflation trend in Europe since 2000

Source: https://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=122.ICP.M.U2.N.000000.4.ANR, downloaded on September 4, 2022

When an increase in the money supply increases overall demand more than the productive capacity of an economy, we have demand-pull inflation. When production costs increase prices, we have cost-push inflation. Quality improvements and technological change are often incorporated into cost-push inflation. Quality improvements would increase prices while technological change tends to reduce prices. Finally, when individuals expect current inflation rates to continue in the future, we have built-in inflation. In general, the longer above average inflation rates persist, the more important built-in inflation becomes. All three of these types of inflation mechanisms are contributing to the recent surge in inflation (Langemeier 2022)

State governments should implement various protectionist measures to ensure stable production and ensure the population's supply of basic foodstuffs. In Table 1, we have seen numerical data on the production of the main cereals, but the differences from year to year can best be seen if we look at the same data from Table 1, graphically shown in Figure 2.

Figure 2. Production of main cereals in EU



Source: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agricultural_production_-_crops#Cereals, downloaded 15.10.2022 22:01

The harvested production of cereals (including rice) across the EU was 286.5 million tons in 2020. This was 12.9 million tons less than in 2019, the equivalent of a 4.3 % decline, and 21.4 million tons less than the record 307.9 million tons recorded in 2014 (see Figure 2).

France harvested 57.5 million tons of cereals in 2020, one fifth (20.1 %) of the EU's total harvested production. Germany harvested 43.3 million tons (15.1 % of the EU total), Poland a further 35.5 million tons of cereals (12.4 % of the EU total) and Spain harvested 26.3 million tons (9.2 % of the EU total).

The overall EU decline in the harvested production of cereals in 2020 was underpinned by steep falls in France (19.2 %, or 13.7 million fewer tones) and Romania (-36.3 %, or 11.0 million fewer tones). However, there were much higher levels in Poland (up 22.5 %, or 6.5 million tons) and Spain (up 32.3 %, or 6.4 million tons).

The EU harvested 119.1 million tons of common wheat and spelt in 2020, the equivalent of 41.6 % of all cereal grains harvested (see Figure 2). This was 12.7 million tons less than in 2019, a decrease of 9.7 %. One reason for this was the weather and the other was the marked reduction in area harvested (down 5.9 % to 20.8 million hectares, in large part due to the adverse weather conditions in Autumn which hindered sowing), (Eurostat 2022).

Table 2. Production of cereals in Republic of Serbia

Production of cereals in Republic of Serbia						
Year	total yield in tons					
	Wheat	Barley	Maize	Oats	Rye	Others
2010	2085529	260998	7207191	78619	11061	48743
2011	2609188	291613	6479564	82577	12791	60339
2012	2399225	278367	3532602	77262	10640	54530
2013	2690266	362205	5864419	88288	13258	69916
2014	2387202	323283	7951583	74932	11702	91691
2015	2428203	362205	5454841	88288	13258	80055
2016	2884537	395501	7376738	81344	14200	100301
2017	2275623	305493	4018370	69538	11248	98586
2018	2941601	410138	6964770	74707	13418	113439
2019	2534643	373340	7344541	56242	12963	102231
2020	2873503	490115	7872607	52135	15240	126404

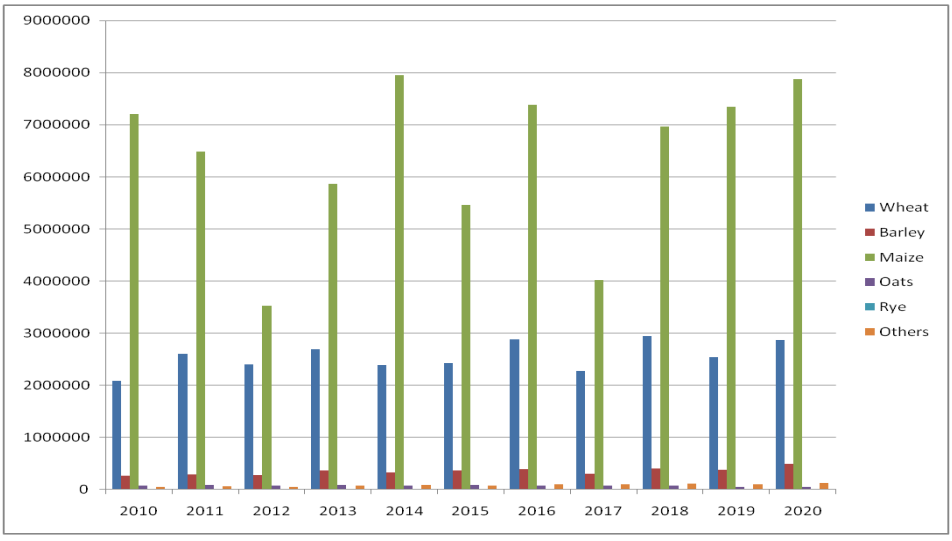
Source: Presentation of the author based on data from Statistical Office of the Republic of Serbia

Note:https://data.stat.gov.rs/Home/Result/130102?languageCode=sr-Latn&displayMode=table&guid=ae1133bd-cc19-41f6-90ae-cc81b689143e

Reference: since 1999 without data for AP Kosovo and Metohija

Arable production in Serbia is small and definitely has a very similar trend to production in the European Union, which is graphically shown in the picture below based on the data from Table 2.

Figure3. Production of cereals in Serbia



Source: Presentation of the author based on data from Statistical Office of the Republic of Serbia

Note:https://data.stat.gov.rs/Home/Result/130102?languageCode=sr-Latn&displayMode=table&guid=ae1133bd-cc19-41f6-90ae-cc81b689143e

Reference: since 1999 without data for AP Kosovo and Metohija.

Serbia is a small country and its contribution to the total crop production in the EU is small. This means that our market production of basic grains is vulnerable and highly susceptible to the influence of both internal and external factors.

Serbia's main task is to minimize the impact of these external factors as much as possible, and to eliminate internal factors through an efficient agrarian policy. Therefore, the state should conduct a simulative policy of agricultural production with a series of benefits for producers in order to obtain stable prices and a stable supply of all necessary agricultural products.

Cereals have a major role in human nutrition, and because of that it is important to compare our production in Serbia with the European Union as a whole. If we look at the statistical share of agricultural production in the total GDP in Serbia , it has been stable in Serbia for the last four years, but if we talk about the real growth of agricultural production, then we will come to the fact that agricultural production is in decline.

Observed by activities, in 2021 the major share in the GDP was noted for the section of manufacturing, 13.0%, the section of wholesale and retail trade and repair of motor vehicles, 11.8%, the section of real estate activities, 6.8%, the section of agriculture, forestry and fishing, 6.3%, and the section of construction, 6.0%. Regarding by the aggregates of GDP use, the share of individual consumption expenditure of households equaled 64.9%, individual consumption expenditure of general government – 10.0%, collective consumption expenditure of general government – 6.9%, gross fixed capital formation – 23.1%, exports of goods and services – 54.5%, and imports of goods and services – 62.3%.

Regarding by activities, in 2021 the section of accommodation and food service activities created the real growth of gross value added (GVA) equaling 31.8%, the section of mining – 29.4%, the section of arts, entertainment and recreation – 26.3%, and the section of construction – 17.6%. The real fall of GVA was noted for the section of agriculture, forestry and fishing, 5.7%. Observed on expenditure side, real growth was noted for all aggregates: individual consumption expenditure of household sector, 7.8%, individual consumption expenditure of government sector – 7.2%, collective consumption expenditure of government sector – 0.2%, gross fixed capital formation – 15.9%, exports of goods and services – 19.5%, and imports of goods and services – 17.7%(Statistical Office of the Republic of Serbia 2022).

Covid 19 was not only a big blow to people's health and to the complete healthcare system of Serbia, but also to the complete chain of supply of basic foodstuffs. We are witnessing the shortage of certain foodstuffs in Serbia during Covid 19, huge queues in front of the large markets and shops due to compliance with measures to protect against Covid 19.

The fact is that psychological factors influenced people to create larger stocks of certain goods such as flour, sugar, salt, and oil, but bearing in mind the commodity reserves, Serbia responded well to the growing demand so that all products could be purchased.

After minor difficulties in the first months after the emergence of COVID 19 the supply of foodstuffs stabilized.

The real GDP growth in the second quarter of 2022, compared to the corresponding period of the previous year, amounted 3.9%.According to seasonally adjusted GDP data, gross domestic product increased by 1.2% in the second quarter of 2022, compared to the previous quarter. Observed by activities, in the second quarter of 2022, compared to the same quarter of the previous year, significant real growth in the gross value added was recorded in the section of wholesale and retail trade; repair of motor vehicles and motorcycles; transportation and storage and accommodation and food service activities – 8.4% and the section of industry and water supply, sewerage, waste management and remediation activities – 4.6%. Real fall in the gross value added was recorded in the section of construction – 7.6% and the section of agriculture, forestry and fishing – 5.4%. (Quarterly Gross domestic product of the Republic of Serbia, II Quarter 2022 ,Statistical Release, National accounts - Quarterly national accounts 31.08.2022, Statistical Office of the Republic of Serbia).

It is not only a problem to ensure an adequate volume of agricultural production for the normal functioning of the supply chain, but also to influence the prices of agricultural products. If the prices of the consumer basket are rising, then it is a big pressure on the economy that has a big social impact. It is primarily a factor of great pressure on wages, which additionally increases the problem of an economy that is faced with a crisis. It is crucial to ensure the availability of food at acceptable prices for both consumers and producers. Regarding this, it is very important to compare the prices of manufacturers, wholesalers and retailers. Special attention should be paid to producers who are very sensitive to several factors, because they are not only affected by the energy and economic crisis, but also by the weather.

Even under ideal conditions without an economic crisis, yield can be compromised by bad weather conditions. That is why it is very important for us to protect agricultural producers. Without them, there is no stable supply and sustainable agricultural production in our country. If we want to ensure uninterrupted supply from our own needs, then the share of agricultural production in the total GDP of our country must be increased.

What is sustainable agricultural production and how to ensure it in a country? This is the type of production that will enable the most optimal use of all available resources for production in accordance with the highest ecological standards and will enable that production to be sustainable in the long term. a country that has food for its population, and in addition has a surplus for export, is at the start in a large competitive advantage in comparison with other countries.

What is the situation in Serbia, and what do we export the most? We have to carefully plan our commodity reserves and make sure that the goods that we need are not exported. If we add to that the results of agricultural production, which is in decline due to last year's drought, and energy and political crisis, we can expect that the prices of agricultural products will certainly rise due to reduced supply.

Prices of goods and services used for personal consumption in September 2022 in relation to August 2022 increased by 1.5% on average. Consumer prices in September 2022 increased by 14.0% in relation to September 2021. Consumer prices in September 2022 in relation to December 2021 increased by 11.4%, on average. Observed by main groups according to the destination of consumption in September 2022 in relation to the previous month, increase of prices was noted in the groups Housing, water, electricity, gas and other fuels (3.8%), Restaurants and hotels (3.7%), Food and non-alcoholic beverages (2.4%), Furnishings, household equipment and routine household maintenance (2.0%), Health (0.6%), Clothing and footwear (0.5%), in the groups Alcoholic beverages and tobacco and Education (each by 0.2%) and in the group Communication (0.1%). Decrease of prices was noted in the groups Recreation and culture (-2.8%) and Transport (-0.3%). Prices of other goods and services mostly remained unchanged.(Consumer price indices by COICOP, September 2022, Statistical Release, Prices - Consumer prices 12.10.2022, Statistical Office of the Republic of Serbia).

The most important resource for agricultural production is arable land, which is abundant in Serbia. There are many questions:

1. How to encourage agricultural production and return people from the cities to the countryside? With serious financial subsidies and the construction of the necessary infrastructure.
2. Will the crisis in food production force us to return to the abandoned farms and fields of our ancestors? Certainly, a certain percentage will because we are facing unemployment, and a large number of people do not have money for basic life needs.
3. Will the energy and economic crisis lead to a decrease in agricultural production due to increased costs? Of course it will.

It is certain that all these factors are very important, and unfortunately they had a negative impact on agricultural production in our country, given that in recent years we certainly have had a negative trend, that is, a real decline in agricultural production.

Stimulants in agriculture are the only solution. It is necessary to stimulate agricultural production with various types of subsidies, but it is also very important to increase the number of crops which are insured by insurance companies. Unfortunately, the prices of insurance premiums in insurance companies have also increased due to inflation.

We have seen that different varieties of agricultural products depend on a very large number of factors: weather conditions, development and implementation of irrigation systems, prices of seeds, fuel, fertilizers and plant protection agents. After production, the price of agricultural products depends on supply and demand, that is, the amount of the yield achieved, but also of the quality of the yield itself. The best quality is reserved for the highest class, which brings with it a favorable price. What the quality of agricultural production will be depends not only on the seeds, applied irrigation measures, climatic conditions, but also on the amount of fertilizers and applied protection

means. So, many factors influence the prices of agricultural products, but that does not mean that we cannot influence the prices. Adequate agricultural and economic policy can influence prices and ensure a stable supply, but some factors, unfortunately, cannot be influenced. If we own arable land, are we also rich in energy resources? We have witnessed that, in addition to the weather conditions, the current increase in energy prices through imported inflation is a very important and unpredictable factor that our producers and the state are powerless to resist. It is imported inflation for which we are not to blame.

Table 3. Price indices of agricultural products in European Union

Price indices of agricultural products						
Cereals (including seeds)-Time frequency Quarterly						
GEO (Labels)	Period					
	2021 Q1	2021 Q2	2021 Q3	2021 Q4	2022 Q1	2022 Q2
EU 27 countries	125,06(p)	129,27(p)	131,17(p)	157,36(p)	171,98(p)	216,7(p)
Belgium	133,69	140,89	144,25	171,57	198,6	247,94
Bulgaria	127,37	127,58	126,59	154,97	165,18	202,07
Czechia	106,7	114,0	114,1	127,6	145,1	182,4
Denmark	112,39	125,62	120,75	135,95	148,65	185,15
Germany*	128,2	133,8	131,8	157	182,8	227,4
Estonia	122,48	127,58	123,38	150,95	176,84	226,88
Ireland	115,33	115,33	141,47	154,54	154,54	154,54
Greece	114,93	114,55	121,44	134,77	126,27	131,05
Spain	115,01	113,97	119,86	153,7	160,75	192,02
France	127,83	126,48	134,09	160,66	174,98	216,94
Croatia	128,69	127,02	114,09	166,13	202,09	209,69
Italy	114,9	124,2	136,4	162,7	176,9	199,2
Cyprus	:	115,85	116,75	:	:	166,37
Latvia	135,33	137,03	127,4	161,79	203,9	244,34
Lithuania	120,63	118,77	114,33	141,95	169,42	218,65
Luxembourg	:	:	135,85	135,85	:	:
Hungary	145,44	157,51	143,9	183,71	227,21	263,56
Malta	:	:	:	:	:	:
Netherlands	134,3	140,1	139,3	165,6	181,8	234,7
Austria	116,7(p)	133,7(p)	120,9(p)	141,1(p)	186,6(p)	216,3(p)
Poland	136,69(p)	148,51(p)	135,85(p)	167,34(p)	202,69(p)	249,4(p)
Portugal	121,61	110	120,03	134,78	114,84	195
Romania	132,56	135,17	139,62	152,51	132,56	215,49
Slovenia	105,39	116,38	113,75	155,31	: (c)	190,62
Slovakia	118,39	127,49	121,95	136,34	173,32	214,37
Finland	118,34	119,97	127,42	171,63	205,83	256,7
Sweden	152,08	139,06	151,72	188,08	234,21	301,88
Price adjustment Nominal index , Unit of measure Index, 2015=100, Last updated: 30/09/2022 11:00						
Note: Special value(: not available, c confidential, p provisional, * until 1990 former territory of the FRG)						

*Source:*https://ec.europa.eu/eurostat/databrowser/view/apri_pi15_outq/default/table?lang=en, downloaded 17.10.2022 12:02

If high costs eat up earnings, then the motivation of agricultural producers decreases, as well as their organizational and financial readiness to continue agricultural production in the following period without reducing the volume of production. In addition to all these factors, unfortunately, agricultural producers often encounter the disloyal behavior of the lobbies of agricultural product warehouses, which negotiate a price that does not suit the producer. On the one hand, we have producers who are very dedicated to their work, who invest a lot of work, effort, time and money, and on the other hand, we have undeniable pressure from the warehouse lobby and buyers. How to overcome this problem. Only through cooperatives and associations of agricultural producers, which, due to low prices, will ensure the storage of products for later sale, or processing in order to avoid losses. Today, earnings are much higher in other economic branches than in agriculture, but if we are guided only by profit, the question arises as to who will be engaged in agriculture and ensure the production of an uninterrupted supply of food. It is also important to invest in the education of agricultural producers, especially in terms of the use of fertilizers and means of protection because many are still ignorant of agricultural production.

Table 4. Price indices of agricultural products in Serbia

Monthly producer price indices of agricultural and fishery products [index]			
REPUBLIC OF SERBIA			
Product	Period		
	2020/august	2021/august	2022/august
Cereals	97.6	125.2	137.2
Wheat	98.0	116.7	154.7
Maize	101.0	142.5	125.4
Indices type: index - from January to the current month (the same period previous year = 100)			

Presentation of the author based on data from Statistical Office of the Republic of Serbia

Source: https://data.stat.gov.rs/Home/Result/03020203?languageCode=en-US, downloaded 17.10.2022 23:06

"The Food and Agricultural Organization of the United Nations "has a "Sustainable Food Value Chains Knowledge Platform" for educating both small and big agricultural producers. This platform is based on FAO's sustainable food value chain (SFVC) framework. The SFVC framework integrates two concepts that have become popular in development thinking and practice over the last decade: sustainability and value chains. These concepts are not always well understood and may be interpreted differently by different people. By being specific about the concepts and how they fit together, the SFVC framework aims to promote a better understanding of their fundamental nature, to facilitate more effective knowledge exchange and implementation (Food and Agriculture Organization of the United Nations 2022).

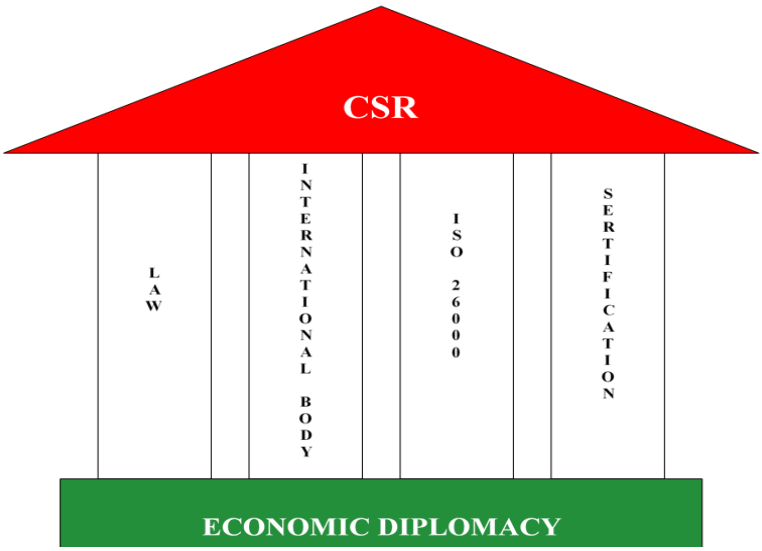
The crisis is evident, the rise of inflation rate and difficulties connected with energy supply have a really great impact on further production and supply of agricultural products. How can we make some improvements in the organization of agricultural production? We can take all the opportunities and comparative advantages of our economy. To use all available resources to improve production, to reduce costs, save energy and increase profits.

Against the backdrop of rising global food insecurity, a recent International Monetary Fund (IMF) paper estimated that higher food and fertilizer import prices will add $9 billion in 2022 and 2023 to the balance of payments of the 48 most affected countries. The war in Ukraine continues to affect food production and distribution amidst a worldwide food crisis already stressed by regional conflicts, climate shocks, and the pandemic. The IMF paper identifies 48 countries, primarily low-income countries in the Sahel and other parts of Sub-Saharan Africa, that are most affected because they face significant import price pressures or have portions of their populations experiencing acute food insecurity, as defined by the World Food Programme (WFP). From a fiscal perspective, the analysis suggests that $5 billion to $7 billion in further spending is needed to assist vulnerable households in these countries. An additional $50 billion is required to end acute food insecurity over the next 12 months (Food security update2022).

The goal is to increase agricultural production, but with a reduction in pollution, which means production in a socially responsible manner. It is crucial to respect the laws and ensure sustainable agricultural production in a sustainable way.

That is why it is necessary to clearly and precisely define the criteria and conditions for measuring CSR in a unique way. This requires the adoption of laws on CSR, the establishment of an international body for CSR control based on the ISO 26000 standard, and the certification of companies that are socially responsible. Successful implementation of CSR is possible, if it is built on solid foundations, with the help of economic diplomacy, and pillars based on compliance with the law, constitution of a body for control and certification of companies in terms of CSR based on compliance with the ISO 26000 standard, (Dejanović 2015).

Figure4. Foundations and pillars of successful CSR implementation



Source: Dejanović, M., (2015). Socially responsible behavior and economic diplomacy, ZadužbinaAndrejević, 75.

Serbia has a competitive advantage when we talk about agricultural production, first of all in the availability of arable land, then favorable climate, the possibility of organic production, as well as the production of certain autochthonous agricultural varieties. The disadvantage is the existence of a large number of small agricultural farms that are not well organized, which need education both in terms of production, as well as in terms of the application of fertilizers, and plant protection products. Association agricultural producers in cooperatives would enable lower costs and more favorable prices and higher profits. Serbia's agriculture must be organized on the principles of state development.

Socially responsible behavior has a special dimension that is much wider than the financial moment. It rises to a higher and more significant level of general concern for civil society and the nation-state. However, the example of moving dirty and heavy industries from developed and less developed countries of the world is not socially responsible behavior. With that, we just transferred the load from one yard to another. Therefore, we must understand socially responsible behavior as a generally responsible concept of work and behavior that takes care of the environmental protection of the entire planet (Dejanović 2013).

Agricultural production is a very important part of the economy of each country because its main task is to obtain food supply with respect to crucial elements of sustainable development.

In the European Union, the Common Agricultural Policy aims to increase agricultural productivity through various methods; to stabilize markets; to ensure fair standard of living for farmers and reasonable prices for consumers – therefore CAP aims at providing food security for the EU citizens, but in a complex manner that ensures sustainable development, the transition toward the green and circular economy, diverse and prosperous in the rural areas. The latter should not be dependent on agricultural activities (Constantin et al., 2021).

Conclusions

The main conclusions of this study are that inflation and the economic crisis deepened after the Covid-19 pandemic, and were further aggravated by the political crisis due to the war in Ukraine and the introduction of sanctions against Russia. This made it difficult to supply energy, causing an energy crisis that pushed the already faltering world economy into an even greater economic abyss. Ahead of the coming winter, the world faces a dangerous energy crisis, which further increases inflation, given that rising energy prices are multiplied in the supply chain. Thus, due to the increase in energy prices, the price of transportation, production, wholesale and retail sales increases agricultural products. Small countries do not have the possibility to influence energy prices on the global market with their policies and are directly exposed to the effect of imported inflation. The only way to mitigate the negative effects of the crisis is to ensure the supply of basic necessities of life.

Conflict of interests

The author declare no conflict of interest.

References

1. Constantin, M., Rădulescu D. I, Andrei V. J., ChivuL.,ErokhinV.,&Gao, T. (2021). A perspective on agricultural labor productivity and greenhouse gas emissions in context of the common agricultural policy exigencies,*Economics of Agriculture, 68(2), (53-67).*
2. Consumer price indices by COICOP, September 2022, Statistical Release, Prices - Consumer prices 12.10.2022, Statistical Office of the Republic of Serbia
3. Dejanović, M., (2013), The impact of the economic crisis on socially responsible behavior, *Tehnika*, vol. *68(2),(343-348)*
4. Dejanović, M., (2015),*Socially responsible behavior and economic* diplomacy, ZadužbinaAndrejević, Belgrade.
5. Eurostat, (2022), Available online: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agricultural_production_-_crops#Cereals,
6. downloaded 15.10.2022 22:01
7. Food and Agriculture Organization of the United Nations (FAO), Sustainable Food Value Chains Knowledge Platform, Available online: https://www.fao.org/sustainable-food-value-chains/what-is-it/en/ , downloaded 17.10.2022 23:02
8. Food security update, (2022). *World Bank*, Last update October 13, 2022, (1-24), Available online: https://thedocs.worldbank.org/en/doc/40ebbf38f5a6b68bfc11e5273e1405d4-0090012022/related/Food-Security-Update-LXXI-October-13-2022.pdf
9. Langemeier,M. (2022). Trends in General Inflation and Farm Input Prices, *Center for Commercial Agriculture*, April 2022,Purdue University, Available online:https://ag.purdue.edu/commercialag/home/wpcontent/uploads/2022/04/20220429_Langemeier-TrendsInGeneralInflationAndFarmInputPrices.pdf
10. Statistical Office of the Republic of Serbia, Available online: https://www.stat.gov.rs/en-US/vesti/statisticalrelease/?p=8856&a=09&s=090201?s=090201,downloaded 15.10.2022 23:07
11. Quarterly Gross domestic product of the Republic of Serbia, II Quarter 2022 ,Statistical Release, National accounts - Quarterly national accounts 31.08.2022, Statistical Office of the Republic of Serbia

THE ROLE OF FINANCIAL MANAGEMENT IN USING DATA MINING IN AGRICULTURAL COMPANIES

Tanja Arapović Ilić[1], Snežana Krstić[2], Miloš Dašić [3], Bojan Brajkovic [4], Radovan Damnjanović [5], Dragana Trnavac [6], Aleksandar Savić [7]

**Corresponding author E-mail: snezana.krstic1966@gmail.com*

ARTICLE INFO

Review Article

Received: *07 December 2022*

Accepted: *15 February 2023*

doi:10.59267/ekoPolj2301267A

UDC 005:336]:[004.8:631.151

Keywords:

agroeconomy, financial management and business, analytical methods, Data mining, group method of data acceptance - Group Method of Data Handling -GMDH

***JEL**: M41, M49*

ABSTRACT

Analytical methods are an indispensable method of auditing. Auditors typically use classical methods such as horizontal, vertical, regression analysis, such as the Z-score. Very few data mining methods are used at all, which are significantly more accurate in their results than the ones mentioned. The subject of this paper is the application of one of the most efficient methods of data so-called. Group Method of Data Handling –GMDH in agro entities.

1 Tanja Arapović Ilić, PhD, Ministry of Defence Republic of Serbia, Birčaninova 5, 11000 Belgrade, Serbia, +38163222158, E-mail: tanja.arapovic@mod.gov.rs, ORCID ID (https://orcid.org/0000-0002-4726-0112)

2 Snežana Krstić, Associate Professor, Military Academy, University of Defence, Veljka Lukića Kurjaka 33, 11000 Belgrade, Serbia, E-mail: snezana.krstic1966@gmail.com, ORCID ID(https://orcid.org/0000-0001-6666-6401)

3 Miloš Dašić, Academy of Vocational Studies South Serbia, Blace Business School Department, st. Kralja Peta I number 1, 18420 Blace, Serbia, Phone: +381 60 41 00 109, E-mail: dasicmil@yahoo.com, ORCID ID (https://orcid.org/0000-0002-6099-8381)

4 Bojan Brajkovic, The University of Business Studies Banja Luka, PhD student, 78000 Banja Luka,Bosnia and Herzegovina E-mail: brajkoboj@gmail.com, ORCID ID (https://orcid.org/0000-0002-8043-9237)

5 Radovan Damnjanović, Assistent Professor, Military Academy, University of Defence, Veljka Lukića Kurjaka 33, 11000 Belgrade, Serbia, e-mail: radovandam78@gmail.com, ORCID ID (https://orcid.org/0000-0002-4574-5546)

6 Dragana Trnavac, Associate Professor, "MB" University, Faculty of Business and Law, Teodora Drajzera 27, 11000 Belgrade, Serbia, E-mail: draganatrbnavac@yahoo.com, ORCID ID (https://orcid.org/0000-0003-1571-4500)

7 Aleksandar Savić, assistant, Military Technical Institute, Ratka Resanovića 2, 11000 Belgrade, Serbia, E-mail: aleksandar22071993@gmail.com, ORCID ID (https://orcid.org/0000-0002-9640-1583)

Introduction

Civilization is nowadays become dependent on large-scale systems of machines, environment and men. Everyday work, performed by auditors and financial experts, in addition to routine-repetitive work, requires knowledge that can be extracted from existing databases, not only data, but also knowledge represented in financial reports. Revision process nowadays, besides classical analytical methods (Z-score, regression analysis, horizontal analysis, vertical analysis includes modern methods of Data Mining (finding implicit - finding hidden knowledge) (Witten & Frank E. (2005)). Based on the cybernetic principle of self-organization, by learning the unknown relations between the outputs and inputs of a given system (in our case financial statements of agricultural entities) based on the evolutionary principle, which understands the initial very simple model of organization to optimally complex model (Savić & Obradović, 2020).

Various studies on agricultural system reveal that fulfilling agricultural production forecasts, particularly in large irrigation systems remains a difficult problem. Difficulties arise which seemingly cannot be overcome by conventional modeling techniques.

Accounting planning deals with the design, systematization, processing and presentation of data related to the future business of the agro company (Ilić & Tasić, 2021). Thus, this constitutive element of management accounting refers to the economic transactions of the agro company that are yet to take place. The end product of accounting planning is accounting estimates that include data on projected balances or changes in the future. Accounting analysis is the judgment and explanation of the state and success of agro business, determining deviations from it, the causes of these deviations and their consequences. The formation of proposals for improving business processes and the situation is also an integral part of accounting analysis (Mihajlović et al., 2020). The main subject of analysis is data and information provided by costing and analysis. The data provided by accounting planning and analysis are necessary inputs for conducting business control. Accountability accounting is a system that connects the plans and actions of each responsibility center in the company (Tekić et al., 2021). The responsibility center is a part of the company whose manager is in charge of a specific set of company activities.

Methodology

„There is no consensus in the literature and practice on the applicability and importance of traditional accounting planning and budgeting in terms of successful management of agro business activities" (Dukić-Mijatović et al., 2021). Conceptual definitions of these two ways of planning reflect differences in understanding the importance of one or another way of planning for the successful operation of the agro company, but also for its survival. The budget, viewed as a result of budgeting activities, is an instrument of effective short-term planning and control. At the same time, the purpose of budgeting, which consists in refining the strategic plan (Spathis et al., 2003), coordination, delegation of responsibilities and creating a basis for assessing performance indicates

the understanding of business budget as an instrument for achieving strategic goals (Vićentijević, 2021).

Putting the achievement of strategic goals in the forefront as budgeting as an instrument represents a broader view of the essence of budgeting. However, the broader understanding of budgeting highlights that planning is becoming the key to good management, that is, that without disciplined professional planning, the agro company goes into disrepair. Profit planning is a budgeting process (Ristić et al. 2021). This approach practically gives maximum importance to budgeting as a process to which the fate of the agro company is tied. Budgeting in a broader sense implies accounting planning and control, whereby budgeting is the responsibility of accounting responsibility (Avakumović et al., 2021). Control in this view implies a comparison with the planned values, which is the essence of control, but budgeting is still more than accounting planning and control, since the essence of budgeting is expressed by flexibility in relation to short-term changes. Machine learning is "a set of processes, which includes: collecting new declarative knowledge, developing and improving motor and cognitive skills through practice, structure of existing knowledge and discovering new facts and theories through observation and active experimentation" (Bogavac et al., 2021).

Learning can be viewed through two basic forms (Green & Choi, 1997):

- knowledge acquisition, which is the learning of new, symbolic information so that it can be effectively applied (so one learns theoretical knowledge, eg physics);
- training, which involves improving some acquired knowledge, mental or motor coordination, through practical repetition and correction of deviations from the desired behavior (so a person learns different skills, with the first phase of learning is the collection of knowledge);
- It is considered that human learning is a mixture of both forms, with mental activities emphasizing the first form, and motor activities to a greater extent the second form of learning.

Machine learning systems are most often divided according to the chosen learning strategy, the way of presenting knowledge and the area of application. Inductive (machine, automated), which is the subject of application in the analysis of financial statements, ie. their learning can be seen as a process in which the system improves its performance on a given task without additional programming, using two methods. We must mention that there are other methods of learning strategy, for example: learning by rote learning, learning by being told, learning by analogy. Learning by examples, which requires inductive reasoning. By analyzing and generalizing solved examples and counter examples of a class of phenomena (financial statements as a concept), we come to a rule, theory or description of the term, which explains all examples and no counter examples. Such learning methods can be further classified according to the choice of examples, source and way of using examples. The methods used by Data mining, which

are not the subject of our consideration, can be: production rules, decision lists and decision trees, which are examples of an understandable way of presenting empirical knowledge. Our focus is on applying a self-organized Data Mining model (SOHK).

Analytical model of self-organized discovery of hidden knowledge (SOHK)

Budgeting has a crucial role to play in agro business. Without a budget (plan), it is difficult to expect managers and their employees to achieve business growth and cost management goals. In developed market economies, financial managers spend 20% -30% of their time on budget-related jobs (Rakić et al., 2021).

In our conditions, the budgeting process is largely excluded from agro business practice. Which is definitely wrong. Agro companies should develop the skills of employees in this field because it will help them not only to discover development opportunities and control their business, and develop an adequate system of rewarding employees, but also to avoid unnecessary costs of paying external consultants when making business plans. (Vukša & Pantić, 2020).

Accountability accounting is a system that connects the plans and actions of each responsibility center in the agro company. The responsibility center is a part of the company whose manager is in charge of a specific set of company activities. Accounting for responsibilities (and thus business control) requires data on the amount and structure of costs of cost centers, ie. control units, as well as data on the amount and structure of the cost price of their services. This data is needed to determine differences in the amount and structure of costs between two or more successive periods, or differences between actual and planned costs, etc., as well as to take appropriate measures to eliminate the causes that led to increased costs. In some cases, measures should be taken against unjustified reduction of costs, if it harms the quality of the product (Mihajlović et al., 2018). For almost every expense, it can be determined where it was incurred. For the purposes of control, responsibility for the amount of incurred costs is essential. When determining the responsibility for the incurred costs and the amount of income, it should be borne in mind that the influence of the competent manager is partially limited, ie. the possibility of their control must be taken into account. Namely, the amount of costs and revenues is partly influenced by external factors, such as purchase or sale prices.

The SOHK model is a model that has significant advantages over classical neural networks and genetic algorithm, because it is based on the principle of evolutionary, mutational and selective approach to generate structure network systematically enabling automated structure synthesis and model validation until the optimal complex model is established (Michalski et al., 1983; Stice, 1991). The self-organization model performs data reduction, reprocessing and validation of model results that are corrected during the self-organization process, which is called self-organization data mining. The SODM model is presented with a group of methods, which is administratively called the Group Method of Data Handling - GMDH).

Group Method of Data Handling

GMDH was developed in the Institute of Cybernetics in Kyiv by Prof. A.G. Ivakhnenko in 1967, with improvements in 1970 and 1980. Group method of data handling represents a system of inductive algorithms for computer-based mathematical modeling in various multicycled systems such as: neural networks, noise immunity, clusterization, economic systems etc. (Ivakhnenko, 1995). Nowadays, there are a wide range of software that uses GMDG, such as: FAKE GAME Project, Gevom, GMDH Shell, KnowledgeMiner, PNN Discovery client, Sciengy RPF!, wGMDH, R Package, R Package for regression tasks, Python library of MIA algorithm.

"Self-organization modeling of inductive algorithms in the basis are using seven fundamental steps:

1. Data sample of *N* observations corresponding to the system under study is required; Split them into training set *A* and testing set *B (N = NA + NB)*.
2. Build up a "reference function" as a general relationship between dependent (output) and independent (input) variables.
3. Identify problem objectives like regularization or prediction. Choose the objective rule from the standard selection criteria list which is developed as "external complements."
4. Sort out various partial functions based on the "reference function."
5. Estimate the weights of all partial functions by a parameter estimation technique using the training data set A.
6. Compute quality measures of these functions according to the objective rule chosen using the testing data set B.
7. Choose the best measured function as an optimal model. If you are not satisfied, choose F number of partial functions which are better than all (this is called "freedom of choice") and do further analysis." (Madala, 1994)

The main advantages of GMDH methods are, in short, solving the problem of applying neural network learning techniques whose algorithms are slower and less efficient than highly optimized algorithms used in statistical software, as well as overcoming the problem of accumulation (Cherkassky & Mulier, 2007). The GMDH algorithm selects a model of optimal complexity by applying an inductive approach.

GMDH algorithm can be presented in Multi - layer artificial neural networks ("There are three main inductive learning networks: multilayer, combinatorial and harmonic. The network structures differ as per the interconnections among the units and their hierarchical levels.") where the structure consider the number of layers and neurons in each layer. Each sumulated unit k receives input variables $(x_i, x_j) \subset x$, $i \neq j$, and generates a function *f()* which is partial form of the reverence function.

$$f(x_i, x_j) = v_0^{(k)} + v_1^{(k)} x_i + v_2^{(k)} x_j + v_3^{(k)} x_i x_j + v_4^{(k)} x_i^2 + v_5^{(k)} x_j^2$$

Where $v^{(k)}$ are the connecting weights. If we denote *0* as the desired values and *y* as the estimated values of the outputs for the function being considered, the output errors would be given by

$$e_p = y_p - O_p; p \in N_A$$

The total squared error for that input vector is

$$E = \sum_{p \in N_A} e_p^2$$

This corresponds to the minimization of the average error *E* in estimating the weights $v^{(k)}$; this is the least squares technique. The weights are computed using a specific traninig sample N_A which is a part of the whole data points *N* specified for this purpose.

Each layer includes a group of units that are interconnected to the units in the next layer. The proces continues layer after layer. Each layer contrains a group of units that are interconnected to the units in the next layer. The weights at each unit are estimated by minimizing the error *E*. The measure of an abjective function is used as the threshold value to make the unit "on" or "off" in comparison with the testing data N_B which is another part of *N* and, at the same time, it is considered to obtain the optimum output response. On this level of modeling, a hardly avoidable error can be reduced to a minimum and finding the solution to optimize the problem, by using the assumed objective function to successive iterations.

"A GMDH network is made up of a number (m) of single neurons (the structure of a single neuron is shown in figure which process the input signal – vector x – and turn it into an output signal, y. The signal is processed when at least two input signals are stimuli, according to the following relation:" (Mrowczynska M., 2019)

$$y = f(x) = f(x_1, x_2, \dots, x_m)$$

where *f* is the transfer function.

"The transfer function must not be too complex, as this would extend the time required for training and would prevent an accurate assessment of the training error. Therefore, although the GMDH algorithm permits the application of various forms of the transfer function, the function is most considered a discrete form of the Volterra functional series which is also called Kolmogorov - Gabor polynomial, defined as: (Mrowczynska M., 2019)"

$$y = a_0 + \sum_{i=1}^{n} a_i x_i + \sum_{i=1}^{n} \sum_{j=1}^{n} a_{ij} x_i x_j + \cdots$$

"where *i, j, a, 0* are polynomial parameters. Assuming that the polynomial has a degree of *n=2*, the transfer function is defined as: (Mrowczynska M., 2019)"

$$y = a_o + a_1 x_1 + a_2 x_2 + a_{11} x_1^2 + a_{22} x_2^2 + a_{12} x_1 x_2$$

This includes the application of external information that was not used to estimate the coefficients of the model.

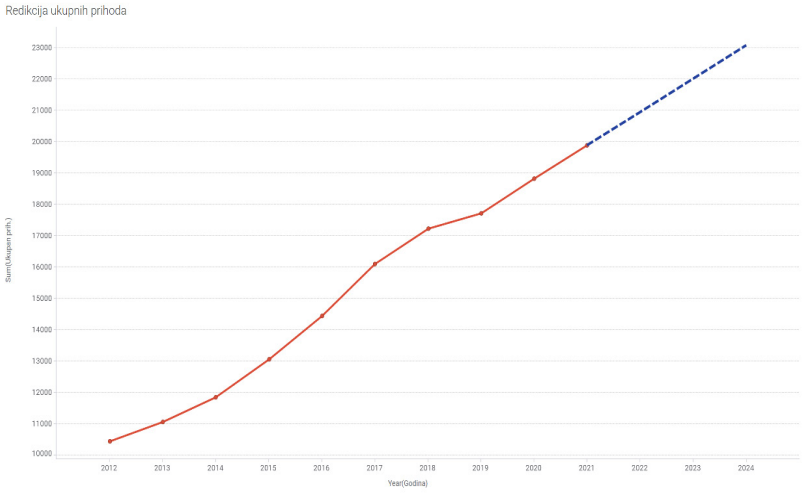
To illustrate the application of this method, we will take the following company data.

Table 1. Financial indicators

Year	Total fixed assets	Cap. investment	Current assets	Capital	Commission	Obligations	Total assets	Total revenue	Operating expenses	Net operating profit	Operating profit
2012	6000	68	2134	1424	2020	3239	8252	10437	11333	235	134
2013	6417	61	2292	2265	2241	2625	8815	11065	11990	313	207
2014	7705	64	2581	2276	2550	3614	10411	11845	12754	303	241
2015	8824	78	3331	3262	2700	4045	12281	13055	14093	314	260
2016	10831	78	3574	3144	2992	6237	14540	14447	15229	305	142
2017	11781	83	4025	2687	3433	7926	15954	16101	17110	11	-301
2018	12459	79	4270	2281	4193	8907	16870	17239	18135	67	-310
2019	12033	91	5183	2137	4429	9210	17410	17731	18597	325	-8
2020	12857	103	5105	3650	6371	7225	18138	18836	19702	596	399
2021	12455	116	5788	4943	6843	6618	18419	19900	20598	837	756

Source: Author's calculation

Figure 1. Reduction of total revenues



Source: Author's calculation

Table 2. Statistics

Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Really	10437	11065	11845	13055	14447	16101	17239	17731	18836	19900			
Prediction	10069	11179	12289	13400	14569	15870	16925	17944	18928	19876	20789	21960	23392
Accumulation													
Final prediction	10069	11179	12289	13400	14569	15870	16925	17944	18928	19876	20789	21960	23392
Lower	9545	10655	11765	12876	14045	15346	16401	17420	18404	19352	20265	21437	22868
Higher	10593	11703	12813	13924	15093	16394	17449	18468	19452	20400	21313	22484	23916

Source: Author's calculation

The results indicate a high level of forecasting accuracy, which qualifies GBDH as an acceptable method of forecasting the movement of the balance of financial statements in every entity, includin agro company.

Conclusion

The changes caused by the information revolution, the development of technology pose new challenges to traditional accounting planning, and make the budgeting process more complex, bearing in mind that these are very significant changes that are happening in the agro business environment. At the same time, it should be borne in mind that the new business conditions are characteristic, among other things, of the increase in the mass of general costs that are not caused by increased production. An approach to budgeting that does not take this fact into account shows a weakness that can have negative effects on the company's operations and the achievement of strategic goals. In this sense, traditional accounting planning works well for activities that show a clear link between inputs and outputs, while otherwise, traditional budgeting serves only to approve a certain level of spending for each cost item.

The article is an attempt to show the success and applicability of Neural Networks, as well as the self-organized Data Mining System. For short-term forecasts of financial indicators. The great advantage of this method is in the fact that it supports nonlinear data forms, such as administrative and financial data. It is to be expected that Data Mining, especially the GBDH method, will become a standard technique for auditors and financial analysts. For directions of further research, the results of the research are expected to be improved by combining models with additional information of macroeconomic categories of the agro economy and building multi-input models for the extended database.

Conflict of interests

The authors declare no conflict of interest.

References

1. Alvin K. Mulashani, Chuanbo Shen, Baraka M. Nkurlu, Christopher N. Mkono, Martin Kawamala, Enhanced group method of data handling (GMDH) for permeability prediction based on the modified Levenberg Marquardt technique from well log data, Energy, Volume 239, Part A, 2022, https://doi.org/10.1016/j.energy.2021.121915
2. Amiri, M., Soleimani, S. ML-based group method of data handling: an improvement on the conventional GMDH. Complex Intell. Syst. 7, 2949–2960 (2021). https://doi.org/10.1007/s40747-021-00480-0
3. Avakumović, J., Obradović, L., & Božić, G. (2021). Management and organization of teamwork in the function of sustainable development. *Održivi razvoj*, *3*(2), 69-80. [*in Serbian*: Avakumović, J., Tešić, R., & Karić, D. (2021). Menadžment tranzicionim procesima u funkciji održivog razvoja].
4. Bogavac, M., Todorović, V., Karić, D., & Rosić, M. (2021). Proof in the accounting control procedure. *Oditor*, *7*(2), 25-35. https://doi.org/10.5937/Oditor2102025B
5. Cherkassky V. & Mulier F. M. (2007). *Learning from Data: Concepts, Theory, and Methods*, 2nd edition, John Wiley - IEEE Press
6. Dukić-Mijatović, M., Uzelac, O., & Stoiljković, A. (2021). Agricultural sustainability and social responsibility. *Ekonomika poljoprivrede*, *68*(4), 1109-1119.
7. Green, B. P., & Choi, J. H. (1997). Assessing the risk of management fraud through neural-network technology. *Auditing: A Journal of Practice and Theory*, 16(1), 8–28.
8. Ilić, B., & Tasić, S. (2021). Quantitative analysis of the role of production in value creation. *Održivi razvoj*, *3*(1), 17-33. [*in Serbian*: Ilić, B., & Tasić, S. (2021). Kvantitativna analiza uloge proizvodnje u stvaranju vrednosti].
9. Ivakhnenko, O.G.; Ivakhnenko, G.A. (1995). *"The Review of Problems Solvable by Algorithms of the Group Method of Data Handling (GMDH)"*. Pattern Recognition and Image Analysis. 5 (4): 527–535.
10. Ivakhnenko A.G., *"Polynomial Theory of Complex Systems,"* in IEEE Transactions on Systems, Man, and Cybernetics, vol. SMC-1, no. 4, pp. 364-378, Oct. 1971, https://doi:10.1109/TSMC.1971.4308320
11. Madala, H.R.; Ivakhnenko, O.G. (1994). *Inductive Learning Algorithms for Complex Systems Modeling.* Boca Raton: CRC Press. ISBN 978-0849344381
12. Michalski. R., Carbonell.J. &.Mitchell T. (Eds.) (1983). *Machine learning: An artifcial intelligence approach (Vol. I).* Morgan Kaufmann, San Francisco.

13. Mihajlović, M., Nikolić, S., & Tasić, S. (2020). Sustainability of the economic model of contemporary economy. *Održivi razvoj*, *2*(2), 7-13. [*in Serbian*: Mihajlović, M., Nikolić, S., & Tasić, S. (2020). Održivost ekonomskog modela savremene privrede].
14. Mihajlović, M., Stanojević, P. & Tešić, A. (2018). Knowledge management as a factor for increasing organization efficiency. *Akcionarstvo*, 24(1), 5-14 [*in Serbian*: Михајловић, М., Станојевић, П., & Тешић, А. (2018), Менаџмент знања као фактор повећања ефикасности организације].
15. Mrowczynska M., Sztubecki J., *Group Method of Data Handling as a Tool to Determine Vertical Displacements*, IOP Conf. Series: Materials Science and Engineering 471 (2019) 052077, IOP Publishing, https://doi:10.1088/1757-899X/471/5/052077
16. Parnicki, P. P., Živković-Petrović, D., & Tucaković, J. (2021). Financial malpractice as a destabilization factor of real financial reporting. *Anali Ekonomskog fakulteta u Subotici*, *57*(45), 149-160. https://doi.org/10.5937/AnEkSub2145149P
17. Persons, O. (1995). Using financial statement data to identify factors associated with fraudulent financial reporting. *Journal of Applied Business Research*, 11(3), 38–46.
18. Rakić, S., Adamović, V., & Špiler, M. (2021). Challenges and directions of developing business communication on the global market. *Oditor*, *7*(3), 67-103.
19. Ristić, K., Miljković, Lj., & Milunović, M. (2021). Investment in the banking sector as a basis for money laundering. *Akcionarstvo*, 27(1), 55-70
20. S.J. Farlow. *Self-Organizing Methods in Modelling: GMDH Type Algorithms.* New-York, Bazel: Marcel Decker Inc., 1984, 350 p.
21. Savić, B., & Obradović, N. (2020). Challenges in financial reporting about biological assets. *Oditor*, *6*(1), 7-21.
22. Spathis, C., Doumpos, M., & Zopounidis, C. (2003). Using client performance measures to identify pre-engagement factors associated with qualified audit reports in Greece. *The International Journal of Accounting*, 38(3), 267–284.
23. Stice, J. (1991). Using financial and market information to identify pre- engagement market factors associated with lawsuits against auditors. *The Accounting Review,* 66(3), 516–533.
24. Tekić, D., Mutavdžić, B., Milić, D., Novković, N., Zekić, V., & Novaković, T. (2021). Credit risk assessment of agricultural enterprises in the Republic of Serbia: Logistic regression vs discriminant analysis. *Ekonomika poljoprivrede*, *68*(4), 881-894.
25. Vićentijević, K. (2021). Challenges of accounting in the modern digital environment. *Revizor*, *24*(93), 27-36. https://doi.org/10.5937/rev2193027V
26. Vukša. S. & Pantić, N. (2020). Profit and profit rate. *Akcionarstvo*, 26(1), 7-25 [*in Serbian*: Вукша, С., & Пантић, Н. (2020), Профит и профитна стопа].
27. Witten I. H. & Frank E. (2005). *Data Mining: Practical Machine Learning Tools and Techniques with Java Implementations*, Morgan Kaufmann Publishers.

IMPACT OF AGRICULTURAL PRODUCTION ON GROSS DOMESTIC PRODUCT IN THE REPUBLIC OF SERBIA

Vera Zelenović[1], Aleksandar Grubor[2], Jelena Zelenović[3], Vladan Vučić [4]

**Corresponding author E-mail: jelena.zelenovic@ivi.ac.rs*

ARTICLE INFO

Review Article

Received: *22 December 2022*

Accepted: *25 February 2023*

doi:10.59267/ekoPolj2301277Z

UDC 330.552:338.43(497.11)

Keywords:

agricultural production, segments, the value of agricultural production, GDP

***JEL**: C100, E200, Q100*

ABSTRACT

The goal of this research is to quantify the influence of each segment of agricultural production individually on the formation of the total gross domestic product in Serbia. For the purposes of the research, the gross domestic product at the level of Serbia, expressed at current prices, was used as the dependent variable. On the other hand, the values of agricultural production (plant production, vegetable production and horticultural products, livestock production, production of livestock products, and agricultural services) expressed also in current prices were observed as independent variables. The research used regression analysis. The most important result of this research is that plant production is recommended as the dominant direction of Serbian agriculture, given that its influence is most pronounced when it comes to the formation of the value of agricultural production, and therefore the total gross domestic product of Serbia.

Introduction

The agricultural sector is crucial for the country's economic growth, food security, job creation, and poverty reduction, especially in rural areas. Agriculture represents an important sector of the Serbian economy, whose participation in the gross domestic

1 Vera Zelenović, Ph.D., Associate Professor, Faculty of Economics in Subotica, University of Novi Sad, Sent-Andrejski put 9-12, 24000 Subotica, Serbia, Phone: +38162233030, E-mail: vera.zelenovic@ef.uns.ac.rs, ORCID ID (https://orcid.org/0000-0003-1012-1773)

2 Aleksandar Grubor, Ph.D., Full Professor, Faculty of Economics in Subotica, University of Novi Sad, Sent-Andrejski put 9-12, 24000 Subotica, Serbia, Phone: +38162474120, E-mail: aleksandar.grubor@ef.uns.ac.rs, ORCID ID (https://orcid.org/0000-0001-9798-0401)

3 Jelena Zelenović, Ph.D., Researcher, The Institute for AI R&D of Serbia, Fruškogorska 1, 21000 Novi Sad, Serbia, Phone: +381628929092, E-mail: jelena.zelenovic@ivi.ac.rs, ORCID ID (https://orcid.org/0000-0002-9162-3857)

4 Vladan Vučić, Associate professor, Faculty of Law, Security and Management "Constantine the Great", 18000 Nis, Union University "Nikola Tesla" Belgrade, Serbia, Tel. +381 63 212 266, E-mail: vladan.vucic@konstantinveliki.edu.rs, ORCID ID (https://orcid.org/0000-0002-4352-2795)

product (hereinafter GDP) of Serbia is around 6%, in the period from 2016-2020. The value structure of agricultural production is dominated by crop production, with a share of about 70%, while the value of livestock production makes up about 30% of the value of total agricultural production. (Ministry of Agriculture, Forestry and Water Management, 2022). In the period 2011–2021. year, the average share of the production of agricultural goods in the total production of agricultural goods and services is 97.6%, while the share of agricultural services is 2.4%. In the same period, the average participation of livestock production output in the total production of agricultural goods and services was 29.3%, while the participation of plant production output was 68.3%. In 2021, the share of crop production in the total production of agricultural goods and services will increase to 75.1%, while the share of livestock production in the total production of agricultural goods and services is 22.5% (Republican Bureau of Statistics, 2022). Increasing agricultural productivity, therefore, requires the adoption of new approaches. A strong connection with the secondary (industrial) and tertiary (service) sectors can play a key role in stimulating economic growth. The agriculture sector remains vulnerable to challenges such as climate change, variations in temperature, water scarcity, and changes in rainfall patterns along with increasing input prices.

Agricultural production more than tripled between 1960 and 2015, globally, thanks in part to modern technologies associated with the Green Revolution (FAO, 2017). It enabled an increase in productivity in agriculture, had a significant impact on the expansion of cultivated land, and had a positive impact on water and other natural resources used for agricultural purposes. All these processes are parallel to the industrialization and globalization of food in agriculture. The consumption of processed, packaged, and prepared food has a growing trend in all rural communities, except for the most isolated ones.

Serbia's strategic orientation towards the EU calls for harmonization of Serbian agriculture with EU standards and methods of agricultural production. Multifunctional agriculture, (Birovljev, 2013), a concept that is also called the "European model" of agriculture, is the opposite of intensively industrialized agricultural production since it advocates the preservation of traditional values, production methods, and people's lifestyles. Its basic characteristic is based on the concept of multifunctionality of rural areas and, therefore, the aspiration towards sustainable development. Non-market functions or positive effects that by definition make agriculture multifunctional are:

a) Food safety,

b) Equal availability of food for all social groups,

c) Adequate rural living conditions, i

d) Protection of the environment (landscape, biodiversity, spread of pathogens and pests).

The advantages of multifunctional agriculture can best be seen if they are compared to the other two types of agriculture, and we distinguish three types of agriculture (Šomođi, 2006):

a) Monofunctional agriculture - represented in economically less developed parts of the world, with unfavorable production conditions, underdeveloped infrastructure, and a large population. The main goal is to provide food for the population at any price;

b) Profit-oriented agriculture - represented in countries with favorable conditions for the production of certain products for the world market based on the criteria of the economy of scale and high efficiency, with the aim of retaining a certain market segment;

c) Multifunctional agriculture - characteristic of the European Union. In addition to the primary function of providing food, it also provides non-market functions.

If the aforementioned views and data are viewed in the context of a comparison with the agricultural sector in the European Union, a certain similarity with Serbian agriculture can be observed. In the structure of agricultural production in the EU, crop production dominates - 53.2% of producers are specialized in crop production, 19.3% of agricultural producers are engaged in growing perennial plants, and 24.5% of producers are specialized in livestock production. The agricultural sector in the EU participates with 1.3% of the GDP of the Union, which is significantly lower compared to this indicator in Serbia. (Ministry of Agriculture, Forestry and Water Management, 2022).

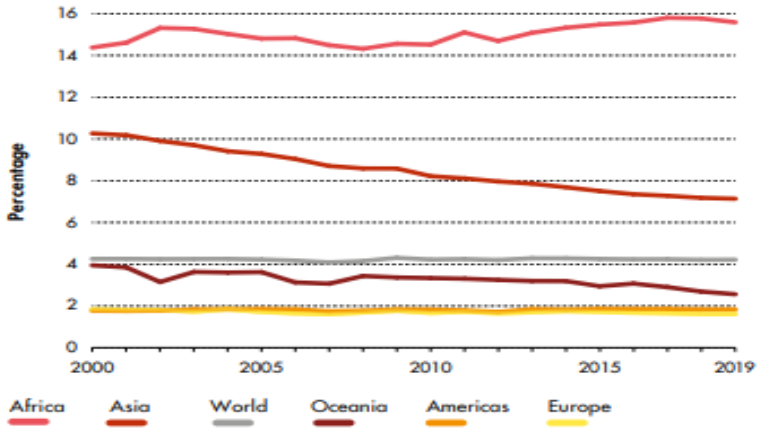
The key factors of agricultural production are (FAO, 2021):

a) Land and water: The area of agricultural land in the world in 2019 was 4.8 billion hectares, which is a decrease of 3 percent, or 0.13 billion hectares compared to the year 2000. Between 2000 and 2019, approximately two-thirds of agricultural land was permanently used, while the share of meadows and pastures declined by 6 percent. One-third of the total agricultural land was arable land and it is 1.6 billion hectares in 2019. The share of water used in agriculture in total water consumption is an indicator of the growing agricultural water compared to industrial and civil (municipal) consumption. The development of irrigation in agriculture is one of the aspects of the intensification of agricultural production, which enabled the total production to grow significantly faster than the growth of cultivated areas.

b) Agricultural workforce: The number of people working in agriculture, forestry, and fishing globally declined by 17% in the period 2000–2020, reaching 874 million in 2020, or 173 million fewer than in 2000. The COVID-19 pandemic has interrupted this general downward trend. While employment fell in all sectors due to restrictions caused by the COVID-19 measures, the industry and service sectors were much more affected than agriculture. All this resulted in an increase in the share of employment in the agricultural sector, in all regions of the world except Europe, in the period between 2019 and 2020.

c) Capital and investments: Capital, which in the agricultural sector includes machines, equipment, and tools, as well as farms (agricultural holdings), is crucial for the production of all agricultural products. Government investment in agriculture is measured by public financial support to the sector and complements investments made by the private sector.

Figure 1. Share of Agriculture, Forestry, and Fishing value added in total GDP by region (USD 2015 prices)



Source: FAOSTAT, 2021.

The share of agriculture in the global GDP, as shown in Graph 1, has a generally downward trend, except when it comes to Africa. When it comes to Europe, the participation in GDP moves from 1.8 percent in 2000 to 1.6 percent in 2019. In Asia, the trend is from 10.3 to 7.1 percent, and from 3.9 percent to 2, 6 percent in Oceania (the share remained practically unchanged in America, where it is 1.8 percent). Growth is recorded only in Africa, from 14.3 percent to 15.6 percent, but with a slight downward trend between 2018 and 2019. The trend for Africa is logical since the rule applies that the share of agriculture in GDP decreases with the economic development of the country, and this development is the slowest in Africa.

The war in Ukraine has affected two of the most important exporters of agricultural products, at a time when food and input prices are already high and volatile on a global level. The concern stems from the fact that the conflict has a potential negative impact on food security, both domestically and internationally. At the national level, escalation could directly limit agricultural production, while at the global level, the war could put additional pressure on international food prices to the detriment of low-income countries with food deficits in particular (FAO, 2022). There is a generally accepted view that countries that are net exporters of agricultural products are winners and that countries that are net importers of such products will, as a result, be losers, due to rising prices of agricultural goods on the international market (Paz et all, 2009).

The goal of the conducted research is therefore to determine which segment of agricultural production contributes the most to the real GDP of Serbia. This would also indicate which of the mentioned segments should be emphasized when it comes to agricultural production.

Literature review

The share of agricultural production in the structure of Serbia's GDP has been declining since the beginning of the 2000s, which is a direct consequence of the faster growth of activities in secondary and tertiary activities. The share of agriculture in the structure of the gross added value of the Serbian economy is still very high and in 2012 it was 10.1%. (Strategy, 2014). The reason for this can be attributed, on the one hand, to the possession of rich land resources, as well as favorable natural conditions for agricultural production, and on the other hand, to the slower process of structural reforming of the rest of the economy, as well as delays in that process.

Small farms, fragmented holdings, and the existing structure of production, accompanied by high production costs and irrational use of resources are the main reasons for lower efficiency in agricultural production (Nestorov-Bizonj, Kovljenić & Erdelji, 2015). Globalization in the agri-food sector leads to growing concentration in all stages of the food chain (Lovre, Gajić & Kresoja, 2011). With economic development, the lawfulness of reducing the contribution of agriculture to the economic development of the country manifests itself (Božić, Nikolić, 2017).

The place and role of agriculture in the economic development of a country are determined by legitimacy (Djurić, 2015; Ristić et al., 2021). The legitimacy is that as the level of economic development of a certain country increases, the relative importance of agriculture decreases. The more economically developed a country is in its economic structure, for example in GDP, the smaller the relative share of agriculture. As for the absolute importance of agriculture in the economies of developed countries, it is never questioned.

As research shows, the agricultural sector in Serbia represents a great development opportunity for economic growth (Stanojević et al, 2015; Milojević et al, 2020). A large part of the economic development of rural Serbia depends on agriculture and agribusiness as factors of both economic development and social stability. To determine the importance and role of agriculture in the development of a country, the following indicators are used (Stipetić, 1987):

a) Participation of active farmers in the total labor force of the given country (alternatively: participation of the agricultural population in the total);

b) Contribution of agriculture to the formation of the income of the given country;

c) Participation of agriculture in the value of the produced social wealth of the given country;

d) Importance of agriculture in international trade.

The participation of agricultural production in the creation of GDP value is an important indicator for both the degree of economic development and the relative importance of agriculture in the economic structure, which is the subject of research in this paper when it comes to GDP and agriculture in Serbia. A significant percentage share of agriculture in GDP is characteristic of those economies in which the primary dominates over the secondary and tertiary sectors, which dominates when talking about less developed

economies. The decrease in the percentage share of agriculture in the total GDP is characteristic of the later stages of the process of economic development.

Agricultural growth has long been recognized as an important instrument for poverty reduction, as discussed by many studies, which focus in particular on quantifying the relationship between agriculture and poverty (Susilastuti, 2018). When we talk about the experience of Western countries related to economic development, rapid structural transformation is focused on agricultural activities, because the primary role of agriculture is to provide food and labor for a growing industrial economy (Olajide et all, 2012; Pantić et al. 2022). GDP is the most important economic indicator in the System of National Accounts that represents the performance of a country's economy in a certain period and most often serves as the basic indicator of a country's economic success. It is arrived at by adding up all goods and services during a certain period (most often a year) in a country and is determined for all institutional sectors individually (Novakovic, 2019). Certain authors have included major segments in agriculture such as major agricultural crops, minor crops, livestock, fisheries, and poultry in their research (Zaman, Khan & Ahmad, 2010). The World Bank (2014) developed a classification of countries based on the role of agriculture in GDP. This classification has the following five levels:

1) Agriculture-based countries: the added value of agriculture is more than 25% of GDP;

2) Pre-transition countries: the contribution of agriculture's added value to GDP declines to less than 25%, but more than 10%;

3) Countries in transition: the added value of agriculture still contributes between 10% and 25% to GDP;

4) Urbanizing countries: the added value of agriculture as a percentage of GDP remains unchanged;

5) Developed countries: the contribution of agriculture to GDP falls to less than 10%.

Many studies have analyzed the impact of the agricultural sector on GDP. Researchers have studied the relationship between GDP and livestock production (Rehman et all, 2017). The Kingdom of Saudi Arabia has set a vision to reduce the country's total dependence on oil sectors by 2030, diversifying the economy to achieve sustainable food security (Emam et all, 2021). The purpose of the research was to analyze the connection and influence of selected agricultural sub-sectors (dates, honey, fish, chicken, and cattle) on agriculture and the growth of the domestic GDP of Saudi Arabia and to identify the leading sub-sector in the economy that could significantly affect the agricultural GDP and other subsectors. Researchers have also studied the cointegration between GDP and the agricultural sector and studied the causal relationship between the gross domestic product and the agricultural sector (Potharla, Satyanarayana, 2011).

The data used to calculate the indicators of the contribution of agriculture to economic development are provided from the national statistical database. In the case of the Republic of Serbia, it is the Republic Bureau of Statistics (Djurić, 2015).

The expansion of (private and public) food standards is associated with the increase in international trade. Consumers in developed countries increasingly demand specific quality attributes of processed and fresh food products and are increasingly aware of food safety issues. Food standards are becoming increasingly strict, especially for fresh food products such as fruits, vegetables, meat, dairy products, fish, and seafood products, which are prone to food safety risks. These requirements for food quality and safety are most pronounced in Western markets (Meijerink, Roza, 2007).

Materials and methods

Liberalization of investment policy encouraged foreign investments in agribusiness, the food industry, and further in the chain, which had great implications for farmers (Dries, Swinnen, 2004). If we look at the movement of GDP in the Republic of Serbia, it has had serious variations since the observed period, from 2012, to reach the highest level in 2018. A slight decline in GDP begins right after 2018, and a noticeable decline occurs in 2019, the most intense period of the pandemic Covid-19 (Figure 2). The return of GDP to the pre-crisis level was already achieved in the first quarter of 2021, and good economic trends continued during the second quarter, and such a result was fully achieved by the recovery of domestic demand. Real GDP growth in the third quarter was contributed by all sectors except agriculture (drought year), and according to the latest data from the Republic Bureau of Statistics, the real GDP growth of the Republic of Serbia in the fourth quarter of 2021 compared to the same period of the previous year was 7.0%.

Figure 2. GDP of the Republic of Serbia, annual real growth rates (%)

Source: Chamber of Commerce of Vojvodina, 2021

Observed from the production side, GDP growth in the fourth quarter of 2021 was led by the services sector (contribution of 4.6 percentage points), primarily due to growth in the activities of trade, tourism, transport, professional and technical services, as well as activities with dominant state participation (state administration, education, and health). Economic activity in the industry sector contributed to GDP growth in the fourth quarter by 0.8 percentage points. The recovery of the private construction industry with the continuation of infrastructure works resulted in an increase in construction of about 11.0% in the fourth quarter (contribution to GDP growth of 0.8

percentage points). The drought during the summer affected the agricultural production of the Republic of Serbia, which in the fourth quarter recorded a drop of around 5.0% (negative contribution to GDP of -0.4 percentage points).

Figure 3. Contributions to quarterly GDP growth rate (%), the production side

Source: Chamber of Commerce of Vojvodina, 2021

In accordance with all the above, the subject of the research that follows is the realized value of agricultural production, shown at current prices, as well as to see to what extent the segments of agricultural production participate in the formation of GDP. Total agricultural production is divided in accordance with the methodology used by the Republic Bureau of Statistics into plant production, vegetables and horticultural products, livestock production, production of livestock products, and agricultural services.

The goal of the research is to quantify the impact of each listed production individually on the formation of the total GDP in Serbia and thus indicate the contribution of each shown production. The research was based on the following assumptions:

H1: The total value of plant production affects the achieved level of GDP in Serbia;

H2: The total value of the production of vegetables and horticultural products affects the achieved level of GDP in Serbia;

H3: The total value of livestock production affects the achieved level of GDP in Serbia;

H4: The total value of production of livestock products affects the achieved level of GDP in Serbia;

H5: The total value of agricultural services affects the realized level of GDP in Serbia.

The period for which the value of realized segments of agricultural production at current prices is observed, together with the values of real GDP in the Republic of Serbia, also expressed in current prices, is from 2018 to 2021, and everything is in accordance with the available data of the Republic Bureau of Statistics of the Republic of Serbia and the National Bank of Serbia.

For the purposes of the research, GDP at the level of Serbia expressed at current prices, served as the dependent variable. On the other hand, the values of agricultural production (plant production, vegetable production, and horticultural products, livestock production, production of livestock products, and agricultural services) expressed also in current prices were observed as independent variables. The research used regression analysis.

Results

As shown in Table 1, in the observed period 2018-2021, there was an increase in plant production in each observed year. When it comes to the production of vegetables and horticultural products, this segment of agricultural production recorded a decline in 2020, which is the year of the Covid-19 pandemic, which can explain this decline. Production already next year in 2021 has a significant growth trend. In the field of livestock production, a slight decrease was recorded in 2019, and this decrease would be more pronounced in 2021. An adequate trend is also noticeable in the production of livestock products. On the other hand, agricultural services recorded constant growth in the observed period.

Table 1. Agricultural output (goods and services) and Real GDP at producers' prices of the current year, 2019–2021. RSD million

Year	Plant production	Vegetables and horticultural products	Livestock production	Production of livestock products	Agricultural services	Real GDP
2018	398513,5	26097,1	176190,4	61660,1	15000,5	1,350,727.4
2019	414528,6	31554,1	175449,7	53480,5	15313	1,472,665.4
2020	473693,3	28125,3	177938,3	54029,2	16223,2	1,497,507.9
2021	544202,2	35756,3	163011	51182,6	17119,2	1,747,067.7

Source: Statistical Yearbook of the Republic of Serbia, 2022.

To test the proposed hypotheses, we will move on to the regression analysis. The regression is used to show whether the proposed variables impact GDP. The results are shown in Table 2-6.

Table 2. Relationship between real GDP and plant production

Indicator	Real GDP				
	Beta Coefficient	R^2	F	*t*	*p*
Plant production	2.392	0.904	18.851	4.342	<0.001

Source: Authors' calculations

For H1, regression was used to test if plant production carries an impact on the real GDP. The variable plant production was regressed on the variable real GDP. Plant production predicted real GDP F (3, 1) = 18.851, p= <0.001, which indicates that plant production plays a significant role in shaping the GDP. The $R^2 = 0.904$ depicts that the

model explains 90% of the GDP. It can be concluded that H1 is accepted.

Table 3. Relationship between real GDP and vegetable and horticultural production

Indicator	Real GDP				
	Beta Coefficient	**R^2**	**F**	***t***	***p***
Vegetable and horticultural production	36.137	0.846	10.973	3.313	<0.001

Source: Authors' calculations

The regression was used to test whether vegetable and horticultural production impact real GDP, for H2. The variable production was regressed on variable GDP. Vegetable and horticultural production predicted GDP F (3, 1) = 10.973, p< 0.001, which indicates that production plays a significant role in shaping the real GDP. The $R^2 = 0.846$ depicts that the model explains 84.6% of the variance in the GDP. Based on the results, it can be concluded that H2 is accepted.

Table 4. Relationship between livestock production and real GDP

Indicator	Real GDP				
	Beta Coefficient	**R^2**	**F**	*t*	*p*
Livestock production	21.628	0.791	7.557	2.753	<0.001

Source: Authors' calculations

For H3, the regression was used to test if livestock production carries an impact on real GDP. The variable livestock production was regressed on GDP. Livestock production predicted GDP F (3, 1) = 7.557, p< 0.001, which indicates that livestock plays a significant role in shaping the real GDP. The $R^2 = 0.791$ depicts that the model explains 79% of the variance in the GDP. According to the results stated above, H3 is accepted.

Table 5. Relationship between the production of livestock products and real GDP

Indicator	Real GDP				
	Beta Coefficient	**R^2**	**F**	***t***	***p***
Production of livestock products	14.148	0.700	4.667	2.160	<0.001

Source: Authors' calculations

For H4, the regression was used to test if the production of livestock products carries an impact on real GDP. The variable livestock products were regressed on variable GDP. Livestock products predicted real GDP F (3, 1) = 4.667, p< 0.001, which indicates that livestock product production plays a significant role in shaping the GDP. The $R^2 = 0.700$ depicts that the model explains as much as 70% of the variance in the real GDP. It can be concluded that H4 is accepted.

Table 6. Relationship between agricultural services and real GDP

Indicator	Real GDP				
	Beta Coefficient	R^2	F	*t*	*p*
Agricultural services	40.936	0.889	16.045	4.006	<0.001

Source: Authors' calculations

Lastly, for H5, the regression was used to test if agricultural services carry an impact on real GDP. The variable agricultural services were regressed on variable GDP. Services predicted real GDP F (3, 1) = 16.045, p< 0.001, which indicates that agricultural services play a t role in shaping the GDP. The R^2 = 0.889 depicts that the model explains 88.9% of the variance in the real GDP. Based on the results obtained, H5 is accepted.

Discussions

The main goal of this paper was to analyze the relationship between real GDP (as a dependent variable) and segments of agricultural production as independent variables. Plant production predicts real GDP F (3, 1) = 18.851, p= <0.001, which indicates that plant production has a very important role in shaping GDP. R^2 = 0.904 shows that the model explains 90% of the variance in GDP. Vegetable and horticultural production predict GDP F (3, 1) = 10.973, p< 0.001, which indicates that this production plays a significant role in shaping real GDP. R^2 = 0.846 shows that the model explains 84.6% of the variance in GDP. Livestock production predicted GDP F (3, 1) = 7.557, p< 0.001, which indicates that livestock plays a significant role in shaping real GDP. R^2 = 0.791 shows that the model explains 79% of the variance in GDP. Livestock products predict real GDP F (3, 1) = 4.667, p< 0.001, indicating that the production of livestock products plays a significant role in shaping GDP. R^2 = 0.700 shows that the model explains as much as 70% of the variance in real GDP. Services predict real GDP F (3, 1) = 16.045, p< 0.001, indicating that agricultural services play an important role in shaping GDP. R^2 = 0.889 shows that the model explains 88.9% of the variance in real GDP. The mentioned results showed that all hypotheses are accepted, that is, that each of the lines of agricultural production has its own influence on real GDP, with the fact that this influence is most pronounced when it comes to plant production. In this way, plant production is recommended as the dominant direction of Serbian agriculture, given that its influence is most pronounced when it comes to the formation of the value of agricultural production, and therefore the total GDP.

A couple of previously mentioned studies in Serbia dealt with this issue in similar research. The study carried out in 2019 (Novaković, 2019) dealt with the analysis of the gross added value of agriculture in the Republic of Serbia, in the observed period of 2002-2015. The analysis in the paper determined that agricultural activity significantly participates in the formation of the total gross added value for the period 2002-2015, providing 11.1% of the total gross added value in relation to all participating activities. Through further analysis, it was determined that the total value of plant production

contributes statistically significantly to the formation of the gross added value of agriculture, from which it can be concluded that the extensive type of production is still dominant. Another study (Stanojević et all, 2015) dealt with the analysis of the production of agricultural goods and services in Serbia for the period 2007-2013. The analysis showed that the production of agricultural goods in the analyzed period participates in the total value with about 97%, while agricultural services record participation of only 3%. Regarding the production of agricultural goods, plant production has a higher share in the analyzed period (about 70%) compared to livestock production (about 30%). Unlike the previous two mentioned types of research, one of which was done in 2019, this research helps to expand the scientific basis when it comes to the influence of the value of agricultural production on the GDP in Serbia. This research determined that the value of plant production, in the structure of agricultural production, has the greatest influence on the real value of GDP, expressed at current prices. This very fact can be decisive for the state administration when it gives guidelines on which type of agricultural production is the most profitable to invest in. The same applies to managers in agriculture, whether in the public or private sector when they decide which is the most profitable segment of agricultural production for further expansion and improvement. The year of the pandemic proved to be a limiting factor when it comes to other elements of agricultural production. It is to be assumed that the results in other segments of agriculture would also have a growth trend in 2020, which would certainly affect the value of agricultural production to be higher. Future research could deal with the factors that influenced the realized value of agricultural production, with an emphasis on those factors that are under the control of the producer (the state), such as improving the value of agricultural production by increasing agricultural productivity, using modern IT technologies, professional training of employees, but also by far greater engagement relying on domestic resources, when it comes to agriculture.

Conclusions

Based on the conducted research, it was determined that the value of agricultural production significantly participates in the formation of real GDP for the observed period of 2018-2021. Further analysis revealed that the total value of plant production statistically significantly contributes to the formation of the total GDP. Although for other segments of the value of agricultural production it can also be concluded that they have a statistically significant influence on the formation of GDP, nevertheless the value of plant production has imposed itself as the dominant direction of the future development of agriculture. The prices of agricultural products increased in the Republic of Serbia by 38.1% in 2021 compared to 2022. The biggest impact on price growth was recorded in the groups of industrial plants (54.8%), grain (42.8%), and livestock and poultry (14.6%). At the end of 2021, mineral fertilizers were three times more expensive in the world and domestic markets compared to the year before. This was contributed by the lack of them on the market caused by the global energy crisis (high gas prices) and the cessation of work of many global mineral fertilizer factories (Chamber of Commerce of Vojvodina, 2021). The obtained results from the analysis, as well as current events at the

national and global level, can be useful to both the creators of agricultural and economic policy. Especially since it is generally known that the development of the primary sector, in the first line of agricultural production, is the basis for the further development of the secondary and then the tertiary sector. Increased agricultural production and productivity tend to significantly contribute to the overall economic development of the country, so it will be quite rational and appropriate to place greater emphasis on the further development of the agricultural sector (Praburaj, 2018).

Conflict of interests

The authors declare no conflict of interest.

References

1. Birovljev, J. (2013). Multifunkcionalna poljoprivreda kao osnova za razvoj agrarne industrije u AP Vojvodini. *Konferencija Performanse i Razvojne Mogućnosti Agrarne Industrije u AP Vojvodini: Prilog regionalnoj strategiji unapredjenja agrarnog biznisa*, 91-130. [in English: Birovljev, J. (2013). Multifunctional agriculture as a basis for the development of agrarian industry in AP Vojvodina. *Conference- Performance and Development Possibilities of Agricultural Industry in AP Vojvodina: Contribution to the regional strategy of agricultural business improvement*, 91-130.] DOI:10.2298/PRMAIV2013091B
2. Božić D., & Nikolić M. (2017). The importance of agriculture in employment structure and degree of economic development. *Agroekonomika*, 46(75), 11-20.
3. Djurić, K. (2015). *Economics of agriculture – practicum*. University of Novi Sad, Faculty of Agriculture, Novi Sad, Serbia
4. Dries, L., & Swinnen, J. (2004). Foreign Direct Investment, Vertical Integration and Local Suppliers: Evidence from the Polish Dairy Sector. *World Development,* 32(9), 1525-1544. http://dx.doi.org/10.1016/j.worlddev.2004.05.004
5. Emam, A.A., Abass, A.S., Elmulthum, A.N., & Elrasheed, M. (2021.) Status and Prospects of Agricultural Growth Domestic Product in the Kingdom of Saudi Arabia. *SAGE Open*. Retrieved from https://journals.sagepub.com/doi/pdf/10.1177/21582440211005451(13.11.2022.)
6. Lovre, K., Gajić M., & Kresoja M. (2011). Globalizacija i održivi razvoj poljoprivrede. *Agrarna i ruralna politika u Srbiji nužnost ubrzanja reformi*. DAES –Društvo agrarnih ekonomista Srbije, Beograd, 1-9. [in English: Lovre, K., Gajić M., & Kresoja M. (2011). Globalization and sustainable development of agriculture. *Agrarian and rural policy in Serbia, the necessity of accelerating reforms*. DAES - Society of Agrarian Economists of Serbia, Belgrade, 1-9.]
7. Meijerink, G., & Roza, P. (2007). *The role of agriculture in development. Markets, Chains and Sustainable Development Strategy and Policy Paper, no. 5*. Stichting DLO: Wageningen. Retrieved from http://www.boci.wur.nl/UK/Publications/ (12.11.2022.)
8. Milojević, I., Mihajlović, M., & Pantić, N. (2020). Collection and documentation of audit evidence. *Oditor*, *6*(2), 77-90. https://doi.org/10.5937/Oditor2002077M

9. Ministarstvo Poljoprivrede, Šumarstva i Vodoprivrede (2022). Nacionalni Program Za Poljoprivredu Za Period 2022-2024. godine. Preuzeto sa http://www.minpolj.gov.rs/nacionalni-program-za-poljoprivredu-za-period-2022-2024-godine/?script=lat (10.12.2022.) [in English: Ministry of Agriculture, Forestry and Water Management (2022). National Program for Agriculture for the Period 2022-2024. Retrieved from http://www.minpolj.gov.rs/nacionalni-program-za-poljoprivredu-za-period-2022-2024-godine/?script=lat(10.12.2022.)]
10. Ministry of Agriculture, Forestry and Water Management Sector for Agricultural Policy (2020). The Report about the situation in Agriculture in the Republic Of Serbia in the Year 2020. Retrieved from http://www.minpolj.gov.rs/download/ZK-2020-I-knjiga.pdf (01.12.2022.)
11. Nestorov-Bizonj J., Kovljenic M., & Erdelji T. (2015). The Strategy for Agriculture and Rural Development of the Republic of Serbia in the Process of its Accession to the European Union. *Strategic management*, 20(3), 57-66.
12. Novaković, T. (2019). Analiza bruto dodate vrednosti poljoprivrede u Republici Srbiji. *Ekonomske ideje i praksa*, 32, 39-55. [in English: Novakovic, T. (2019). Analysis of the gross added value of agriculture in the Republic of Serbia. *Economic ideas and practice*, 32, 39-55.]
13. Olajide, O.T, Akinlabi, B. H., & Tijani, A.A. (2012). Agriculture resource and economic growth in Nigeria. *European Scientific Journal*, 8(22), 103-115.
14. Pantić, N., Mikulič, K., & Lekovič, M. (2022). The influence of claims payments on the investment portfolio of insurance companies. *Oditor*, *8*(3), 42-71. https://doi.org/10.5937/Oditor2203042P
15. Paz, J., Benavides, H., & Arias, J. (2009). Measuring Agricultural GDP Performance: A Technical Route. *Comuniica Magazine*, *Inter-American Institute for Cooperation on Agriculture*, 1-12.
16. Potharla, S., & Satyanarayana, K. (2011). Co-integration and Causal Relationship Between GDP and Agriculture Sector. *International Journal of Research in Commerce & Management,* 2(11), 66-68.
17. Praburaj, L. (2018). Role of Agriculture in the Economic Development of a Country. *International Journal of Commerce,* 6(3), 1-5. DOI: https://doi.org/10.5281/zenodo.1323056
18. Privredna komora Vojvodine (2021). Privredna kretanja u AP Vojvodini u 2021. godini. Preuzeto sa https://pkv.rs/pkv/files/privredna_kretanja/kretanja/2021/Привредна%20кретања%20у%20АП%20Војводини,%20I-IV%202021.%20године.pdf (25.11.2022.) [in English: Chamber of Commerce of Vojvodina (2021). Economic trends in AP Vojvodina in 2021. Retrieved from https://pkv.rs/pkv/files/privredna_kretanja/kretanja/2021/Привредна%20кретања%20у%20АП%20Војводини,%20I-IV%202021.%20године.pdf (25.11.2022.)]
19. Rehman, A., Jingdong, L., Chandio, A. A., & Hussain, I. (2017). Livestock production and population census in Pakistan: Determining their relationship with agricultural GDP using econometric analysis. *Information Processing in Agriculture,* 4(2), 168–177.

20. Republički zavod za statistiku (RZS) (2022). Ekonomski računi poljoprivrede u Republici Srbiji za period 2011–2021. Preuzeto sa https://www.stat.gov.rs/sr-cyrl/publikacije/?d=10&r= (14.11.2022.) [in English: Republic Bureau of Statistics (RBS) (2022). Economic accounts of agriculture in the Republic of Serbia for the period 2011–2021. Retrieved from https://www.stat.gov.rs/sr-cyrl/publikacije/?d=10&r= (14.11.2022.)]
21. Ristić, K., Miljković, Lj., & Milunović, M. (2021). Investments in the banking sector as a basis fof money laundering. *Akcionarstvo, 27*(1), 55-68.
22. Stanojević, J., Krstić, B., & Đekić, S. (2015). Analiza produktivnosti rada sektora poljoprivrede Republike Srbije. *Ekonomske teme*, 53(4), 479-494. [in English: Stanojević, J., Krstić, B., & Đekić, S. (2015). Analysis of the labor productivity of the agricultural sector of the Republic of Serbia. *Economic topics*, 53(4), 479-494.]
23. Stipetić, V. (1987). *Poljoprivreda i privredni razvoj*. Informator, Zagreb, Hrvatska [in English: Stipetic, V. (1987). *Agriculture and economic development*. Informator, Zagreb, Croatia]
24. Strategija poljoprivrede i ruralnog razvoja Republike Srbije za period 2014-2024. godine. "Sl. glasnik RS", br. 85/2014. Preuzeto sa http://uap.gov.rs/wp-content/uploads/2016/05/STRATEGIJA-2014-2020-.pdf (10.11.2022.) [in English: Agriculture and rural development strategy of the Republic of Serbia for the period 2014-2024. "Official Gazette of RS", no. 85/2014. Retrieved from http://uap.gov.rs/wp-content/uploads/2016/05/STRATEGIJA-2014-2020-.pdf (10.11.2022.)]
25. Susilastuti, D. (2018). Agricultural Production and its Implications on Economic Growth and Poverty Reduction. *European Research Studies Journal*, 21(1), 309-320.
26. Šomođi, Š. (2006). Neke karakteristike multifunkcionalne poljoprivrede. *Agroekonomika – Tranzicione reforme i agroprivreda*. 34, 90-130. [in English: Somodji, S. (2016). Some characteristics of multifunctional agriculture. *Agroeconomics - Transitional reforms and agriculture*, 34, 90-130.]
27. The Food and Agriculture Organization of the United Nations (FAO) (2017). *The future of food and agriculture – Trends and challenges*. Rome, Italy. Retrieved from https://www.fao.org/3/i6583e/i6583e.pdf (07.12.2022.)
28. The Food and Agriculture Organization of the United Nations (FAO) (2021). *World Food and Agriculture - Statistical Yearbook*. Rome, Italy. Retrieved from https://www.fao.org/3/cb4477en/online/cb4477en.html (07.12.2022.)
29. The Food and Agriculture Organization of the United Nations (FAO) (2022). The importance of Ukraine and the Russian Federation for global agricultural markets and the risks associated with the war in Ukraine. Retrieved from https://www.fao.org/3/cb9013en/cb9013en.pdf (30.11.2022.)
30. World Bank Group (2014). Enabling the Business of Agriculture: Progress Report. Washington, DC, World Bank. Retrieved from https://openknowledge.worldbank.org/handle/10986/21501 (15.11.2022.)
31. Zaman, K., Khan, M.M., & Ahmad, M. (2010). Assessing the Poverty Bias Growth Agriculture Sector. *International Journal of Trade, Economic and Finance,* 1(3), 303- 308.

EUROPEAN LEGAL FRAMEWORK OF RURAL DEVELOPMENT POLICY

Nina Maksimović Sekulić[1], Tamara Vujić[2], Milan Stanković[3]

**Corresponding author E-mail: nina.maksimovicbg@gmail.com*

ARTICLE INFO

Review Article

Received: *12 February 2023*

Accepted: *13 March 2023*

doi:10.59267/ekoPolj2301293M

UDC 340.137:332.46.2(4-672EU)

Keywords:

rural development policy, EU regulation, CAP, long-term vision for the EU's rural areas

***JEL**: K3, Q1*

ABSTRACT

New social demands, opportunities in the green economy, opportunities opened up by digital technology, and the consequences of the COVID-19 pandemic and the spread of remote work have again drawn attention to rural areas. In 2020, the European Commission conducted a public consultation on the long-term vision for rural areas. Support for rural areas is already provided under several EU policies, which contributes to their balanced, fair, green and innovative development. To support the implementation of the action plan, the common agricultural policy (CAP) and the cohesion policy will be of particular importance, which will be accompanied by a whole range of policies from other areas.The aim of this paper is an analysis of the EU legal framework of rural development policy, together with an analysis of the further development of the LEADER approach. Finally, a special focus is placed on the analysis of documents (long-term vision for the EU's rural areas) that deal with the future of rural development in the EU.

Introduction

According to the Article 174 of "the TFEU", the Union must strive to reduce "the differences between the levels of development of different regions, paying special attention to certain regions, especially rural areas. The rural areas of the EU are of great importance as places for food production, forests and energy production, especially renewable energy. They make up 83% of the total European territory and that about 137 million people live there (30% of the European population). The population in rural

1 Nina Maksimović Sekulić, Ph.D., Associate professor, Modern business school Belgrade, st. Terazije num. 27, 11 000 Belgrade, Serbia, tel num: +38162 206 642, Email: nina.maksimovicbg@gmail.com, ORCID ID: (https://orcid.org/0000-0002-4330-0666)

2 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)

3 Milan Stanković, PhD, Full professor, Faculty of Law, Security and Management "Konstantin Veliki", 18000 Nis, Serbia, E-mail: milan.stankovic@konstantinveliki.edu.rs, ORCID ID (https://orcid.org/0000-0002-1397-8150)

areas has slightly decreased at the EU level during the past decade and significantly during the last 50 years, and that the population will probably decrease by 2050 in four out of five rural regions of the EU, whereby remote rural areas lose more inhabitants. In order to successfully respond to the main trends and challenges arising from globalization, urbanization and population aging, policies and measures adapted to each area are needed that take into account the diversity of EU regions, their specific needs and their relative advantages.

Rural development measures have a very important role in the context of key priorities and strategies of the European Commission, within "the new CAP for the period 2021-2027, especially within the framework of the European green plan and the long-term vision for rural areas". (European Parliament resolution 2021/2254(INI)) On the basis of established drivers, scenarios and numerous consultation activities, four mutually complementary areas of action were determined, which together form a long-term vision whose foundation, inspiration and goal are stronger, connected, resilient and prosperous rural areas by 2040. In the context of the European Green Plan, the new European growth strategy, rural areas will play an important role in turning Europe into "the first climate-neutral continent by 2050". In rural areas, for the needs of the green transition, partnerships will need to be developed in all economic activities, among companies from all sectors, local authorities, researchers and services based on innovation, knowledge exchange and collaboration, among others within the framework of smart specialization processes (EU Green Deal).

The aim of this paper is an analysis of the EU legal framework that regulates rural development policy, together with an analysis of the further development of the LEADER approach, the reliability of "the European Regional Development Fund", "the European Network for Rural Development". Finally, a special focus is placed on the analysis of documents ("long-term vision for the EU's rural areas" and EU green plan) that deal with the future of rural development in the EU.

Materials and methods

Based on the set goals, the analysis of the content of secondary data sources was used as the basic methods of research. Secondary data, information on "the EU policy of rural development", "LEADER approach" were taken mostly from "the official European Commission" documents and relevant literature (Literature reviews; in depth-analysis of rural development policy regulations and the framework for their implementation in Member States); an analysis of EU green plan regarding objectives; an analysis of "long-term vision for the EU's rural areas".

Results

Rural development in the EU - legal aspect

Rural development in the currently form, was not a part of the early European agricultural policy, and only at the end of the sixties of the 20th century it begin to appear as an issue within its framework as part of the so-called of the Mansholt plan. The aim of this plan was to introduce measures of rural development in order to solve the issue of reducing the number of small farms while at the same time trying to maintain a vibrant rural economy. (The Mansholt Plan, 1969)

This was followed by several directives that determine in more detail the issue of the further course of rural development. They related to: (Bogdanov, 2018)

- Modernization of farms through investment assistance in order to maintain parity income with other economic sectors ("Council Directive of 17 April 1972 on the modernization of farms (72/159/EEC");
- program for consolidating holdings and reducing the number of employees ("Council Directive 72/160/EEC of 17 April 1972 concerning measures to encourage the cessation of farming and the reallocation of utilized agricultural area for the purposes of structural improvement");
- "Advisory service, training, education" ("Council Directive 72/161/EEC of 17 April 1972 concerning the provision of socio-economic guidance for and the acquisition of occupational skills by persons engaged in agriculture").

The effects of these measures were insignificant. Much better results followed the adoption of the Regulation 355/77, which referred to" support for the development of processing and marketing of agricultural and forestry and fishery products" (Council Regulation (EEC) No 355/77 of 15 February 1977 on common measures to improve the conditions under which agricultural products are processed and marketed).

It is significant to specify the strategies focused on rural areas that have been present in" the EU rural development policy" since the 1980s, when the turn from exogenous to endogenous development concept began. The key principle of these models is reliance on local development potentials and their innovative parts, that is, local structures and members of the local community.

The policy of rural development in the EU developed from a policy that deals with the structural problem "of the agricultural sector", to a policy that deals with the multiple role of agriculture in society. (Đorđević-Milošević and Milovanović, 2012; Cvijanovic & Pantovic, 2021)

Therefore, based on the above, it can be pointed out that the EU policy of rural development is formulated and applied at two levels:

1. EU strategic guidelines,
2. National strategic plans - National strategies, programs and directives.

Based on their national priorities, which are aligned with the EU framework, MS develop plans to implement policies "at the national and regional level". In the strategic guidelines, the EU defines the permitted support measures, and the member states choose from that list those measures that correspond to the needs of their rural areas. Most rural development programs basically refer to support in the form of grants, loans, incentives, transferred payments and fiscal policy solutions. "Support for rural development" is grouped into three groups of measures or so-called: (Tasic, 2015)

1. Growth in "the competitiveness of the agricultural sector" (highly positioned on the list of priorities of the countries of CEE that joined the EU last and whose rural areas will go through structural changes for a long time). As measures within this group, the following are mentioned: 1. Investments in the modernization of machinery and equipment on farms; 2. Giving value to agricultural and forestry products; 3. Support for cooperation between farmers, food industry and producers of raw materials; 4. Vocational training; 5. Support for young farmers; 6. Support for the use of advisory services and for the establishment of farm management systems; 7. Support for infrastructure projects.

2. Improvement of the environment and rural areas. Measures within this group include: 1. Support for non-productive investments related to the realization of agro-ecological obligations; 2. Support for regions with less favorable conditions for development; 3. Support for the protection of domestic animal welfare; 4. Sustainable use of forest land.

3. Diversification of economic activities and quality of life. Measures within this group include: 1. Support for the diversification of activities towards non-agricultural activities; 2. Support for the creation and development of new businesses; 3. Encouraging tourist activities; 4. Support for starting basic services; 5. Training and informative activities; 6. Support for acquiring new skills and animating rural areas.

The importance of the LEADER approach in EU rural development policy

It is important to point out the importance of the new approach in politics, in which the specific role of rural areas is taken as the focus. This turn in policy was marked by the European Commission's 1988 Communication "*The Future of Rural Society*", and support for rural development from the Structural Funds began in 1989. (COM (88) 501) After that, the first version of "the LEADER" ("Liaisons entre actions de developpement de l'économie rurale") approach was launched in 1991, which was largely compiled by European Commission official Michael Lane, who had previously worked on local employment initiatives in Mediterranean countries. The importance of these dimensions differs depending on: the degree of general development of a

given society, basic characteristics of rural areas (from completely marginalized to favor), a model of rural development that can represent a centralized, decentralized, i.e. exogenous, endogenous and mixed approach. The concept of multifunctionality emphasizes that the agricultural production system, in addition to its basic functions, also includes a strong socio-demographic component, as well as institutional solutions and implementation instruments, assessment of potential economic, ecological, social and global effects in assumed conditions for various tested local/regional case study models. (Ilic, Hafner, 2018)

In this regard, it is significant to specify two main regulations:

1. "Council Regulation (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD)". It defines the roles and key responsibilities of the Governing Body and other institutional structures in the field of rural development, provides definitions of elements - the LEADER principle, local action groups - LAGs and cooperation.

2. "Commission Implementing Regulation (EU) No 679/2011 of 14 July 2011 amending Regulation (EC) No 1974/2006 lying down detailed rules for the application of Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development".

"LEADER I began as a pilot initiative (1991-1993) of the European Commission" which invited local partnerships (local action groups - LAGs) from poor rural areas from 12 EU countries to submit local action plans for funding through the distribution of integrated global grants. The European team that carried out the ex post evaluation of LEADER I, in cooperation with the LEADER II Observatory, laid the conceptual foundations of what is now called the CLLD11/LEADER "approach" or "method", defined as the combined application of seven operational principles. (Bogdanov, 2018)

LEADER II (1994-1999) LEADER I very quickly built a reputation as an innovative instrument for mobilizing the endogenous potential of marginalized rural areas. Therefore, in 1994, the European Commission decided to extend it in the form of a decentralized approach in partnership with member states. LEADER II was subsequently implemented through 102 national/regional operational programs (OPs) in 15 EU countries. (Bogdanov, 2018)

LEADER+ (2000-2006) the community initiative LEADER+ was designed in the third phase to encourage the implementation of integrated, quality and original sustainable development strategies. It had a strong focus on partnerships and networks and promoted the exchange of experiences. As indicated in the name itself, LEADER+ included additional improvements, specifically the following features: the principle of "innovation" was combined with the regulatory principle of "sustainability"; participation of public stakeholders in decision-making bodies is limited to 50%; Increased emphasis has been placed on cooperation between rural areas – including the possibility of supporting joint rural development projects between LEADER LAGs

and similar structures within the same member state. LEADER+ continued to play its role as a laboratory aimed at stimulating the emergence and testing of new approaches to integrated and sustainable development, as well as complementing other rural development programs by encouraging rural communities to design and implement integrated and innovative development strategies. The organization of LEADER+ measures in the member states that joined the EU during this period followed the same approach as in the 15 EU countries, although more emphasis was placed on initial capacity building and the implementation of pilot strategies. (Bogdanov, 2018)

LEADER (2007-2013) With the introduction of the LEADER approach in the main streams of "the rural development program" (EU25+2), LEADER was established as the fourth axis, transversal in relation to the other three and with available funds in the amount of 5% of the total budget. The member states that joined the EU in 2004 have a fixed amount of 2.5%, mostly for preparations and capacity building measures.

CLLD /LEADER (2014-2020) in this period, this method is applied to all "European structural and investment funds" ("ESI funds") under the name Community-led local development (CLLD). CLLD is still managed under the name LEADER in the EAFRD (measure 19 within focus area 6b) as mandatory in all 118 rural development programs (28 EU countries) with a minimum allocation of 5% of "the rural development program budget" (2.5% for Bulgaria) and Romania, which joined the Union in 2007, and a specific arrangement for Croatia, which joined the program in 2014.

A new declaration calling for an improved LEADER/CLLD implementation framework resulted from a stakeholder-driven process at the Renewing LEADER/CLLD for 2020+ conference organized by the European LEADER Association for Rural Development (ELARD in November 2016 in Tartu, Estonia). ELARD's 'Tartu declaration' suggests a decrease in bureaucracy and a simplified multi-funded CLLD through a single funding source managed by a one coordinating body following one unique set of rules at the EU level be part of the new framework. LEADER will be delivered through the national co-financed CAP Strategic Plan (CSP)1 for the 2023-2027 period. LEADER supported actions will contribute to achieving the aims of the CSP Specific Objective: "to promote employment, growth, gender equality, social inclusion and local development in rural areas, including bio-economy and sustainable forestry".

European Network for Rural Development

"The European Network for Rural Development" ("ENRD") acts as a clearinghouse on how policies, programs, projects and other initiatives for rural development work in practice and how they can be improved to make them more effective. Its goal is to bring together everyone who wants and can contribute to rural development in Europe.

It supports the effective implementation of the rural development programs of the EU member states by spreading knowledge and developing new knowledge and by

facilitating the exchange of information and cooperation among rural communities across Europe. In addition, (ENRD) is a rich source of information on the implementation of rural development programs in the EU, including:

- Project database: a detailed list of projects financed by "the EAFRD and implemented through the rural development programme",
- Rural development in numbers: statistical data and summaries related to rural development programs, focus areas and data obtained from monitoring,
- Thematic work within ENRD: thematic working groups, seminars, workshops and publications,
- Frequently asked questions related to rural development.

Support for the implementation of these activities is provided by the ENRD contact point and "the European Rural Development Evaluation Support Service".

European Agricultural Fund for Rural Development

"The European Agricultural Fund for Rural Development" ("EAFRD") is the funding instrument of the second pillar of the EU's Common Agricultural Policy (CAP). It aims to reinforce the 'first pillar' of income supports and market measures by strengthening the social, environmental and economic sustainability of rural areas. ("Regulation (EU) No 1305/2013 – support for rural development"; "Regulation (EU) No 1306/2013 on the financing, management and monitoring of the common agricultural policy and repealing Council Regulations"). „The EAFRD is an integral part of the European Structural and Investment Funds - ESI, i.e. one of the five instruments for achieving the goals of the Europe 2020 Strategy". The European Fund for Regional Development is one of the most important factors in strengthening the Union's economy. Its fundamental task is to finance development projects with the aim of reducing regional differences in development and strengthening social cohesion and inclusiveness.

All projects are implemented on the basis of the structural adjustment of the economic systems of the member countries and the support of cross-border cooperation in terms of the transfer of labor and means of production. Also, this fund is the most important instrument in achieving the goals envisioned by the cohesion policy of the Union. This policy enables quick and effective assistance to countries that are exposed to natural disasters. Furthermore, the aid is manifested through the financing of projects to improve the demographic picture of border and mountain regions, which are characterized by a low rate of population density. Furthermore, with the aim of correcting regional differences in development, the Fund finances the development and structural adjustment of the economic systems of less developed member countries. The neutralization of differences in development should have been achieved by transforming industrial branches in underdeveloped regions to ones based on knowledge, technologies and innovations.

The legal framework of the operation of the European Fund for Regional Development defines that each member state must allocate at least 5% of financial resources to the Union budget. These funds, from the European and structural funds are further channeled for the needs of integrated action in terms of sustainable urban development. This refers to all those environmental, climatic, economic, demographic and social issues and challenges that affect social and regional partners. In accordance with the operational development programs that each member state defines according to its own needs, within the framework of the EAFRD there is the possibility of direct financing of investments in companies on the territory of the Union. Small and medium-sized enterprises are intended to play a key role in creating sustainable jobs, increasing the competitiveness of Union companies on the world market, developing infrastructure related to the efficiency of research and development, telecommunications networks, environmental protection and sustainable development, and the transition to green energy (Fernández-González et al., 2022). Also, the Fund's investment in growth and employment - with the aim of strengthening the labor market and regional economies European territorial cooperation - with the aim of strengthening cross-border transnational and interregional cooperation within the European Union, provide financial instruments to support local and regional development in terms of overcoming risky business and financial losses. Therefore, this fund can certainly be a significant source of funds for small and medium-sized enterprises, considering that it is possible to finance almost half of the project amount through it. Acceptable activities within such projects are, for example, the acquisition of new technologies, investment in innovative production, introduction of research and development, etc.

In conclusion, "the main activities of the European Agricultural Fund for Rural Development" include financial support for projects intended for small and medium-sized enterprises, which contribute to the preservation and creation of new jobs, investments for the construction of an infrastructure system whose primary goal is to provide effective services to the population of the Union in the field of energy, environmental protection and sustainable development, better traffic connections and quality supply of information and communication technologies. Furthermore, it is important to note the large amount of money allocated for the development of social and health care that is, the construction of educational infrastructure, and the creation of preconditions for neutralizing economic differences between individual regions of the EU.

In the financial perspective for the period from 2021 to 2027, the Fund foresees tasks, the implementation of which would make the Union and its regions more competitive on the world market in terms of innovation and support for small and medium-sized enterprises, i.e. their digitization and Internet connectivity. Also, the transition to a "green" and low-carbon way of doing business, better mobility of the labor force, better education, greater social inclusion and equal access to social and health care systems, as well as stronger investment in science and culture, and sustainable tourism should help the implementation of the stated goals. The characteristic of this fund is divided management. The creation of projects that should be adapted to their own needs is invited by local authorities, and it is governed by the Regulation on Common Provisions

"From 2023 onwards, rural development actions will be included under the framework of national CAP strategic plans. Each EU country will design a CAP Strategic Plan, combining funding for income support, rural development, and market measures. When designing their strategic plans, EU countries will contribute to the nine specific objectives through a toolbox of broad policy measures provided by the Commission, which can be shaped around national needs and capabilities. Within this framework, the Commission aims to make rural development actions more responsive to current and future challenges such as climate change and generational renewal, while continuing to support European farmers in a sustainable and competitive agricultural sector".

A path for "the future of rural areas for 2040"

"European Commission communication sets out a long-term vision for the EU's rural areas up to 2040 to ensure that rural areas can continue to play these essential roles". "It identifies areas of action towards stronger, connected, resilient and prosperous rural areas and communities". "A Rural Pact and an EU Rural Action Plan with tangible flagship projects and new tools will help achieve the goals of this vision". The European Parliament's motion voted captures the complex economic and social challenges Europe's rural areas are facing. It presents a number of important solutions to ensure that rural communities are brought along the green transition. (European Parliament resolution 2021/2254(INI))

While rural areas in Europe are profoundly diverse from an historical, geographical, and economic perspective, they often face similar social and economic challenges. For instance, access to high-quality services of general interest, demographic decline and ageing, vulnerability to the impacts of crisis, and political underrepresentation are just some of the challenges affecting rural communities. (Miller and the others, 2022)

It was based on foresight exercises, background research and analysis of data relating to rural areas, and consultations with citizens and other rural actors. It recognizes the challenges and concerns (e.g. shrinking and aging population, lack of connectivity, absence of diverse employment opportunities) of rural areas, and aims to address these by using the most promising opportunities in rural areas (e.g. the EU's green and digital transitions, lessons learnt from the COVID 19 pandemic, potential for economic growth). The Vision proposed a Rural Pact and a Rural Action Plan which are to be key elements of making rural areas stronger, connected, resilient and prosperous: (Miller and the others, 2022;)

- Rural Pact: The Pact aims to engage actors from multiple governance levels to support the goals of the Vision, facilitate cohesion in the area of the economy, society, and territory, and participate in the common aspirations of rural communities.
- Rural Action Plan: The Action Plan, aims to stimulate sustainable, cohesive and integrated rural development via various EU policies that will jointly support turning the Vision into a reality.

"Rural communities must have equal access to services of general interest to ensure inclusive and fair conditions of life and well-being, in particular health services, education, training and retraining" and lifelong learning, social care, care for children and the elderly, connectivity and mobility and housing, as well as postal and banking services, places for social gatherings and cultural activities and infrastructure; in this regard, he emphasizes the importance of public investments and public partnerships, as well as the improvement of cross-border and rural-urban cooperation; highlights the potential of decentralized and multi-purpose service centers and adapted repurposed buildings, as well as innovative approaches to service delivery. (European Parliament resolution 2021/2254(INI))

Targeted interventions to support young people and encourage effective generational renewal should be a priority in order to encourage the permanent presence of young people in rural areas and solve the problem of demographic decline; stresses that special attention should be paid to overcoming the main challenges and removing existing barriers, such as access to higher education and knowledge transfer, employment opportunities, acquisition of business skills and access to land and capital; stresses the need for high-quality agricultural education systems to train young professionals; in this regard, he emphasizes the important role of young farmers in modernizing EU agriculture and creating more opportunities in rural areas; stresses that it is necessary to support their successful integration, especially by facilitating the purchase and leasing of agricultural land, emphasizing in this regard the potential of agricultural incubators. (European Parliament resolution 2021/2254(INI))

The EU Green Deal, including a farm-to-table strategy and digital transformation, opens up new opportunities in rural areas, new dynamics for a more resilient future and opportunities for sustainable jobs; stresses the need to ensure a just and inclusive transition, promoting rural economic vitality and territorial and social cohesion, and to provide adequate support and resources to face the challenges in this regard, especially in light of the current crisis. The areas covered by the European Green Plan and the goals foreseen within them are: (EU Green Deal)

- Clean energy
- Biodiversity – implementation of ecosystem conservation measures
- Sustainable industry – encouraging a more sustainable, environmentally friendly production cycle
- Construction and renovation – implementation of measures to achieve a cleaner construction sector
- Sustainable agriculture – sustainability in EU agriculture and rural areas thanks to the common agricultural policy
- "From field to table" strategy - encouraging the development of more sustainable food systems

- Elimination of pollution – implementation of measures for quick and efficient reduction of pollution
- Sustainable mobility – promoting more sustainable means of transport
- Climate – make the EU climate neutral by 2050.

Furthermore, the importance of supporting cooperation initiatives in agriculture and social economy as a tool for rural development is highlighted; draws attention to the role of agro-food cooperatives in "the environmental, economic and social sustainability of rural areas, adding value to products, creating jobs and diversifying the local economy; encourages the Commission and Member States to encourage and promote cooperatives in rural areas". The importance of access to adapted investments, research and innovation for sustainable agriculture is emphasized; notes the success of the European Innovation Partnership on Agricultural Productivity and Sustainability and calls for the continuation and expansion of this bottom-up innovation approach to find tailored solutions designed by local stakeholders, as well as other rural innovation partnerships and innovation hubs multi-stakeholder; believes that innovation should be aligned with traditional practices and knowledge, especially those adapted to the characteristics of each area, as well as diversification and innovation in the rural economy, with a more territorial approach based on local potential and characteristics, key to exploiting opportunities from the digital and green transition. (European Parliament resolution 2021/2254(INI))

Member States should introduce measures that support the just transition and diversification of the rural economy and support the creation of quality jobs in rural areas; emphasizes the potential of biodistricts, ecoregions, carbon sequestration and ecotourism for the diversification of the rural economy; reminds that sustainable agriculture, forestry and fishing can also offer opportunities for business diversification in rural areas. (European Parliament resolution 2021/2254(INI)).

Tourism will represent an important source of income for rural communities, highlighting the potential of diverse models of sustainable tourism; highlights the often underutilized potential of recreational fishing and angling tourism for attracting tourists throughout the year; calls for efforts to strengthen the position of rural tourism, such as wine tourism, in strategies for the diversification of the rural economy, together with the agricultural and food sectors. (European Parliament resolution 2021/2254(INI)).

In the upcoming period, the Commission and MS will promote the involvement of women in agriculture, especially by researching the possibility of supporting co-ownership of European agricultural farms; demands that the work of women in agricultural activities, especially the work of spouses and partners who help in agriculture, be fully recognized by granting legal recognition and full access to rights from the social security system; emphasizes the role of women in rural areas in the transition to sustainable agriculture and in the green transition. (European Parliament resolution 2021/2254(INI)).

Initiatives in rural areas, such as the development of renewable energy infrastructure, must effectively contribute to the economic, social and environmental vitality of those areas and take into account the need for social acceptance at the local level; insists that food production targets and the protection of areas of high ecological value, such as Natura 2000 network areas, should be a priority. (European Parliament resolution 2021/2254(INI)).

It is necessary to plan infrastructure that does not neglect any region, especially by strengthening public investments and quickly implementing EU funds and national funds that contribute to connectivity in rural areas, by supporting and developing integrated and intermodal transport systems, and by giving priority to isolated and disconnected areas in the trans-European transport network. (European Parliament resolution 2021/2254(INI))

The digital transition opens up new opportunities for rural areas, which are only available if there is adequate, stable, fast and affordable broadband coverage, which has not been completed in all rural areas; points out that digital development increases the attractiveness of rural areas, reduces problems related to remoteness, improves access to services and facilitates digitization in agriculture; calls for the creation of high-speed local "digital centers" adapted to remote work. (European Parliament resolution 2021/2254(INI)).

The risks of widening the digital divide in rural areas due to the lack of coverage of 5G technology must be taken into account and Member States are invited to mobilize all available instruments to improve the full deployment of 5G networks and remove administrative obstacles, with special support from EU cohesion policy funds and member states' plans for recovery and resilience, as well as private investments; stresses the need for a timely revision of the relevant guidelines on state aid for non-market rural areas; the comparative lack of digital skills in rural areas can prevent rural communities from taking advantage of digitization opportunities and hamper the development of small and medium-sized enterprises (SMEs). (European Parliament resolution 2021/2254(INI)).

Measures are needed at EU and national, regional and local levels to ensure digital inclusion, especially in the context of an aging population, and promote adapted digital skills while supporting an enabling environment for innovation and the development of adapted digital solutions; highlights the potential of digital tools for sustainable agriculture and smart agriculture, for developing a local, short supply chain and for increasing the attractiveness of the agricultural sector for young farmers. (European Parliament resolution 2021/2254(INI)).

In the upcoming period, smart villages stand out as a leading project of the EU action plan for rural areas in order to better promote their development after 2020; stresses the importance of balanced public-private partnerships in this context; highlights the potential of smart city technologies, which should be adequately financed, and considers that the digital platform "Smart City Market" could serve as a model for the further development of the ecosystem of smart villages; stresses that the rural economy and

the LEADER development method and community-led local development financing instruments should also be used for the further development of smart villages. (European Parliament resolution 2021/2254(INI)).

Conclusions

"Europe's rural areas are home to 137 million people representing almost 30% of its population and over 80% of its territory". The motion includes important recognition of game management and its social, economic, cultural and biodiversity benefits as well as a key request to reduce conflicts with large carnivores (Sagić et al., 2019).

By the middle of 2023, the European Commission will analyze the measures taken by EU member states in rural areas and prepare a public report based on this in early 2024. This will play a key role, especially in identifying areas that still need increased support and funding. The report will pave the way towards a rural strategy for the programming period 2028-2034.

In the upcoming period, a strong rural dimension is expected in the cohesion policy regulations, which should include dedicated funds for this purpose. The European Commission will launch a study on the possibility of allocating part of the European Fund for Regional Development and the Cohesion Fund for rural areas, along with other useful investments, with special emphasis on regions with special geographical features such as mountains, remote areas, islands and outermost regions. The future and well-being of rural areas is crucial for Europe's food security, autonomy and resilience, as well as for a sustainable energy mix that contributes to the EU's energy independence, as the recent COVID-19 pandemic and the Russian invasion of Ukraine have clearly shown.

In the coming period, the long-term vision is expected to develop into a concrete and measurable true rural strategy at the EU level, including strategic dialogue on cooperation with urban areas, and coordination of the contribution of all EU funds and policies to rural areas; stresses that this strategy must be fully integrated into future programming periods; calls on all member states to develop rural strategies at the national and regional level that will define the ways and means needed to solve the problems facing rural areas.

In conclusion, the Vision highlights four specific themes under which action will be taken, supported by flagship initiatives: "Stronger: Rural areas should be home to empowered and vibrant local communities, involving a broad range of stakeholders and networks as well as all levels of governance, is key to developing tailor-made, place-based and integrated policy solutions and investments; Connected: Maintaining or improving public transport services and connections, as well as deepening digital infrastructures, are essential to ensure better-connected EU rural areas; Resilient: Preserving natural resources, restoration of landscapes (including cultural), greening of farming activities and shortening supply chains to make rural areas more resilient to climate change, natural hazards and economic crises; Prosperous: Diversifying economic activities to new sectors with positive effects on employment, and improving the value added of farming and agri-food activities".(Miller and the others, 2022).

Member States should support community-led local development, including LEADER, by encouraging participation in local action groups, facilitating and promoting multi-fund approaches and ensuring the effective autonomy of local action groups in terms of their composition and decision-making; considers that a meaningful allocation of aid for CLLD within all relevant funds at EU level, similar to the European Agricultural Fund for Rural Development (EPFRR), would contribute to stronger integrated strategies and more sustainable and resilient territorial development;

In the coming period, the European Commission should improve synergies and coordination between EU funding instruments such as cohesion policy, CAP and the Next GenerationEU recovery instrument, as well as with national instruments, for successful rural development in the EU, as well as pay special attention implementation of "Article 174 of the TFEU" and to guarantee that the principle of "doing no harm to cohesion" is applied in all EU policies, especially in rural areas.

Conflict of interests

"The authors declare no conflict of interest".

References

1. Bogdanov, N., (2007). *Small rural households in serbia and rural non-agricultural economy*, UNDP Belgrade, Serbia.
2. Commission communication transmitted to the Council and to the European Parliament, The future of rural society, (1988) COM (88) 501 final, 28 July 1988. Bulletin of the European Communities, Supplement 4/88 Retrieved from https://ec.europa.eu/ (February 01, 2023)
3. Cvijanovic, D., Pantovic, D. (2021). Comparative Analysis of Macroeconomic Indicators of Candidate Countries for the EU: Results of Promethee - Gaia Approach, Globalisation challenges and the social-economic environment of the EU, Conference proceedings, Novo mesto, Slovenia, 116-125.
4. Đorđević-Milošević, S., & Milovanović, J. (2012). *Small farms and rural tourism in Serbia*. Belgrade: Singidunum University - Faculty of Applied Ecology Futura.
5. EU Green Deal, Retrieved from https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en (February 01, 2023)
6. European Commission (2021a). Long-term vision for rural areas – Building the future of rural areas together, Retrieved from https://ec.europa.eu/info/strategy/priorities-2019-2024/new-push-european-democracy/long-term-visionrural-areas_en (February 02, 2023)
7. European Commission (2021b). Commission Staff Working Document, Accompanying the Communication on A long-term Vision for the EU's Rural Areas - Towards stronger, connected, resilient and prosperous rural areas by 2040, Part 1. European Commission, pp 46.

8. European Commission (2021c). Commission Staff Working Document, Accompanying the Communication on A long-term Vision for the EU's Rural Areas - Towards stronger, connected, resilient and prosperous rural areas by 2040, Part 3. European Commission, pp 82.
9. European Commission (2021d). Annex to the Communication on a Long-Term Vision for the EU's Rural Areas – towards stronger, connected, resilient and prosperous rural areas by 2040. Retrieved from https://ec.europa.eu/info/sites/default/files/strategy/strategy_documents/documents/ltvra-c2021-345- annex_en.pdf (February 02, 2023)
10. Fernández-González, R., Pérez-Vas, R., & Puime-Guillén, F. (2022). Small companies facing the mobility policy in Spain: Is it profitable to remain in the market?. *Transport Policy*, 128, 113-120.
11. Ilic, M., & Hafner, N. (2018). *The institutional framework of sustainable rural development with reference to the local community*, Proceedings of the International Scientific Conference, Regional development and cross-border cooperation.
12. Implementation of the LEADER approach in the countries of the Western Balkans - "From local initiative to the main concept in rural areas" (2018), [editors Natalija Bogdanov ... et al.]. - Skopje: Permanent Working Group for Regional Rural Development in SEE (SWG)
13. Mansholt, S. (1970). The Mansholt Plan – Studies, *An Irish Quarterly Review*, 59(236), 404 - 418.
14. Miller, D., Chartier, O., Salle, E., Zomer, B., Irvine, K., & Schwarz, G. (2022). *First set of recommendations for development of future rural policies SHERPA*: Sustainable Hub to Engage into Rural Policies with Actors
15. Regulation (EU) No 1305/2013 – support for rural development Retrieved from https://eur-lex.europa.eu/ (February 03, 2023)
16. Regulation (EU) No 1306/2013 of the European Parliament and of the Council of 17 December 2013 on the financing, management and monitoring of the common agricultural policy and repealing Council Regulations (EEC) No 352/78, (EC) No 165/94, (EC) No 2799/98, (EC) No 814/2000, (EC) No 1290/2005 and (EC) No 485/2008 Retrieved from https://eur-lex.europa.eu/ (February 03, 2023)
17. Regulation (EU) 2021/2115 of the European Parliament and of the Council of 2 December 2021 establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) and repealing Regulations (EU) No 1305/2013 and (EU) No 1307/2013.
18. Sagić, Z., Lakićević, M., & Durkalić, D. (2019). Analysis of tourist turnover in a rural tourism destination–case study of Ivanjica. *Economics of Agriculture*, 66(3), 835-850. DOI: https://doi.org/10.5937/ekoPolj1903835S

19. Tasic, S. (2015). Implementation of EU agro-economic policy on agricultural and rural development of Serbia, *Doctoral dissertation*, Bussines academy, Novi Sad.
20. Council Directive 72/160/EEC of 17 April 1972 concerning measures to encourage the cessation of farming and the reallocation of utilized agricultural area for the purposes of structural improvement, Retrieved from https://eur-lex.europa.eu/ (February 03, 2023)
21. Council Directive 72/161/EEC of 17 April 1972 concerning the provision of socio-economic guidance for and the acquisition of occupational skills by persons engaged in agriculture Retrieved from https://eur-lex.europa.eu/ (February 04, 2023)
22. Council Directive of 17 April 1972 on the modernization of farms (72/159/EEC), Retrieved from https://eur-lex.europa.eu/ (February 04, 2023)
23. Council Regulation (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), Retrieved from https://eur-lex.europa.eu/ (February 04, 2023)
24. Commission Delegated Regulation (EU) No 807/2014 of 11 March 2014 supplementing Regulation (EU) No 1305/2013 of the European Parliament and of the Council on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) and introducing transitional provisions Retrieved from https://eur-lex.europa.eu/ (February 04, 2023)
25. Commission Delegated Regulation (EU) No 640/2014 of 11 March 2014 supplementing Regulation (EU) No 1306/2013 of the European Parliament and of the Council with regard to the integrated administration and control system and conditions for refusal or withdrawal of payments and administrative penalties applicable to direct payments, rural development support and cross compliance Retrieved from https://eur-lex.europa.eu/ (February 05, 2023)
26. Commission Implementing Regulation (EU) No 679/2011 of 14 July 2011amending Regulation (EC) No 1974/2006 laying down detailed rules for the application of Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD) Retrieved from https://eur-lex.europa.eu/ (February 05, 2023)
27. European Parliament resolution of 13 December 2022 on a long-term vision for the EU's rural areas – Towards stronger, connected, resilient and prosperous rural areas by 2040 (2021/2254(INI)) Retrieved from https://eur-lex.europa.eu/ (February 05, 2023)
28. Commission Implementing Regulation (EU) No 809/2014 of 17 July 2014 laying down rules for the application of Regulation (EU) No 1306/2013 of the European Parliament and of the Council with regard to the integrated administration and control system, rural development measures and cross compliance Retrieved from https://eur-lex.europa.eu/ (February 06, 2023)

SERBIAN AGRARIAN POLICY IN THE VORTEX OF HIGH INFLATION AND GEOPOLITICAL RISKS

Jugoslav Aničić[1], Milan Vujić[2], Dušan Aničić[3], Željko Vojinović [4]

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

ARTICLE INFO

Review Article

Received: *20 February 2023*

Accepted: *20 March 2023*

doi:10.59267/ekoPolj2301309A

UDC
338.435:336.748.12(497.11)

Keywords:

agriculture, inflation, monetary policy, Serbia

***JEL**: D04, D25, Q14*

ABSTRACT

Attempts to solve economic crisis by a massive injection of money into the financial system have caused inflation in most highly developed countries. World economy is burdened by a high inflation, excessed demand, over indebtedness, in one word unready for the challenges that followed on the geopolitical level, and have spilled over into the economy. This situation has also affected agriculture, while the rise in food prices was particularly sensitive because it has affected the population life standard. All existing weaknesses of the economic and agrarian policy of Serbia and absence of a serious long-term strategy in this seriously in crisis sector's development have surfaced. This paper analyses a situation in the Serbian agricultural sector, which has been pressured at the same time by bad agrarian policy, numerous internal weaknesses and big geopolitical risks.

Introduction

Since 2008, the developed countries have started printing large amounts of money, and lowering interest rates even below zero. These measures were first announced as temporary, but they have lasted more than a decade. In the beginning, the central banks assessed that the prices increase was a transient phenomenon caused by the post-

1 Jugoslav Aničić, PhD, Full Professor, Faculty of Economics and Finance, University Union-Nikola Tesla, Cara Dušana 62-64, 11000 Belgrade, Serbia, Phone: +381 64 24 77 199, E-mail: ajugoslav@yahoo.com, ORCID ID (https://orcid.org/0000-0003-3467-7071)

2 Milan Vujić, PhD, senior lecturer, Academy for Applied Studies Belgrade, The College of Hotel Management, Street Kneza Višeslava no. 70, 11030 Belgrade, Serbia, Tel. +381 69 844 90 03; E-mail: milan.vujic@vsar.edu.rs, ORCID ID: (https://orcid.org/0000-0002-5870-0224)

3 Dušan Aničić, PhD, Assistant Professor, Faculty of Economics and Finance, University Union-Nikola Tesla, Cara Dušana 62-64, 11000 Belgrade, Serbia, Phone: +381 64 40 82 692, E-mail: anicic.dusan@yahoo.com, ORCID ID (https://orcid.org/0000-0003-1201-0532)

4 Željko Vojinović, PhD, Associate professor, University of Novi Sad, Faculty of Economics, Segedinski put 09-11, 24000 Subotica, Serbia, Phone: 00381 24 628 037, E-mail: zeljko.vojinovic@ef.uns.ac.rs, ORCID ID (https://orcid.org/0000-0002-2685-5504)

pandemic demand growth and bottlenecks in production and transport. This is how a low interest rate policy was explained despite of more and more obvious inflation. The inflation in the west developed countries nowadays have achieved a level last seen forty years ago. Economies of many countries have already facing a recession and the great debt crisis. The biggest victims of such economic processes will be developing countries, because due to pandemic their budgets are in serious problems, while they are additionally threatened by the energy and food cost growth. The only solution is to take on additional debt, but now at higher interest rates, which leads to recession, increase in unemployment and a real drop in wages.

The financial markets ongoing has separated from the real economy a long time ago, while the central banks have cared more about the interests of a financial sector than the real economy. The global economy has been facing the prices growth and has been necessary to determine a cause-and-effect relationship between causes and factors, which have been causing the growth of prices and economic policy conducted in the modern economy. As a rule, the inflation is a monetary phenomenon, i.e. it occurs due to disruption of the ratio of available money and available products and services in one country. During 2022, the pandemic was seized high developed countries of the west, and its negative effect was reflecting to all economic sectors and the population life standard. Agriculture has found itself under the impact of inflationary trends, so it has become, together with energetics, a sector of the highest inflation, particularly in the field of food prices.

The agricultural sector in Serbia is in big problems for a long time, and since this crisis was occurred, all weaknesses of the economic and agrarian policy following this sector have come to the surface. Primarily, there has come to a lack of goods we traditionally produce – sugar, oil, milk, meat, as well as their prices increase. Serbia wasn't supporting the agricultural production as necessary trough the subsidy system, and it was affecting the price increase for products we produce sufficiently. On the other hand, traders (middlemen) profit from the prices increase, and the least profit manufacturers (the example of raspberry, etc.), in the overall chain the least profit direct manufacturers, farmers. There are fewer and fewer people in villages engaged in agriculture, and we are still not capacitated to produce more (and better quality) with much less people. Domestic manufacturers are put out by an indiscriminate import although Serbia is a country with comparative advantages in the agricultural production and the traditional food exporter.

This paper's goal is to indicate the need for improving policy, programmes and initiatives in term of competitiveness increase of the Serbian agricultural production, pointing out the significance and role of agricultural sector in a complex geopolitical surrounding, and suggesting future activities according to the previous experience in order to come closer to agriculture production opportunities of the developed European countries. Thus, this paper can be useful to the agricultural policy holders and professional public interested in these problems.

Global monetary policy – the biggest cause of inflation in developed world

Macroeconomists took credit for the results in the beginning of nineties until the economic crisis emergence in the middle of 2007, which referred to positive tendencies such as relatively low and steady inflation, and significantly milder income fluctuation. That is why Bernanke (2004, p. 1) named this period a period of „Great Moderation", which occurrence he explained by the structural changes in economy, the improvement of economic policy, but also by favourable circumstances owing to smaller and less frequent shocks that hit economies.

Under the new consensus in monetary policy Mishkin (2006, p. 1) considered, *inter alia* , the acceptance of postulates that there were no long-term „trade off" between output (employment) and inflation, and then that expectations were of great importance for the monetary policy results, as well as the central banks independence was helpful in improving the monetary policy efficiency. On the other hand, Goodfriend (2007, pp. 24-31) recognized four key elements of this consensus: (1) Stability of prices; (2) Base inflation targeting; (3) The importance of credibility for low inflation; (4) Preventive policy of interest rates supported by transparent goals.

Blanchard, Dell'Ariccia and Mauro (2010, p 10) considered that a steady and low inflation in the period of consensus was the primary, if not the only goal of the central banks. Lavrač (2002, p 4) suggested that if there were the alternative goals beside the price stability, such as the stabilisation of an economic growth rate or an unemployment rate, they would have to be subordinated to a primary goal. However, after the Great Moderation period, with the onset of the crisis in August 2007, it was clear that there was necessary to reassess the previous comprehension, strategies, effects, i.e. the role of monetary and fiscal policy in forthcoming period.

The prices of raw materials are globally increasing, especially energy sources, after a long-term period of the expansive monetary policy, relying on the inflation targeting and a general price level. The significance of so-called "nominal anchor" as a lock for the excessive growth of inflation has opened the gate to different targeting regimes as the monetary policy strategies (targeting exchange rate, money supply, price level and inflation). The inflation targeting mostly respects attitudes defined within the new consensus, making the monetary policy a significant factor for the establishment of macroeconomic stability (Marjanović, Mihajlović, 2012; Pantić et al., 2022).

Regardless of which variant of targeting inflation is used, the great importance is attached to the transparency of monetary policy and public communication. Thereby, there can be set aside four transparency standards a central bank should be complied with (Blinder, 2002): 1) clarity in public communication, 2) announcing a crucial relevant information, 3) openness of the central bank for public control, 4) enabling the general public insight into all central bank's activities. Compliance with these standards is crucial owing to the public trust, and especially owing to the economic subject' correct expectations forming, as an important condition of the monetary policy success.

An important issue regarding the monetary policy operationalization in targeting inflation regime is about an optimal inflation rate. It often points out that the central bank should not target an inflation rate of 0%, because a positive and low inflation rate (around 2%) can have more positive effects (Sinclair, 2003; Rakić et al., 2021). The positive inflation rate can alleviate the establishment of balance on market, particularly in case of an aggregate demand. Besides, the impact of a nominal interest rate reduction, under the central bank control, can have better effect on a real interest rate reduction at a higher inflation rate, since the nominal interest rate cannot be negative. This argument gain its importance after the crisis in 2008, so there were some recommendations that the inflation target level should be increased to 4%, in order to expand the manoeuvring space for the real interest rate reduction as a necessary respond to the recession (Blanchard, Dell Ariccia, 2010).

Numerous researches have shown that targeting inflation provides also good macroeconomic results. For example, the monetary policy regime based on targeting inflation affects a job market in a way it provides lower unemployment in regard to targeting exchange rate, although this relationship significantly depends on the economy openness level (Larsson, Zettergerg, 2003). Some studies show the positive impact of targeting inflation on the economic growth, as well as on the loss reduction in output in case of the disinflation process implementation (Mollick, Torres, Carniero, 2008.).

On the other hand, there is an opinion that inflation has been significantly reduced in those countries which have adopted this regime, primarily owing to initially high inflation rates and the existence of a global trend of falling inflation, and not exclusively as a result of the implementation of targeting inflation (Ball, Sheridan, 2003).

The situation on financial markets have separated from the real economy a long time ago, while the central banks, as it seemed, have cared much more about financial than the real economy. Thanks to cheap money, in 2021 were recorded the historical records in purchasing, merging and consolidation of companies, therefore the global companies and monopolies were becoming more and more powerful, and the wealth centralization more pronounced (Katić, 2022).

Targeting inflation as a monetary strategy belong to a group of so-called new Keynesian theories based on the assumption that the monetary policy role reflects in anchoring the economic subjects' expectations. It is very important as well to have a consensus on conducting monetary policy often based on clear rules, in order to provide the stable inflation, and not determined on a discretionary basis (Djukić et al. 2010). Besides, targeting inflation reflects also through the increased transparency through public communication and markets regarding the plans and goals of a monetary policy creators, as well as greater responsibility of a central bank in the inflation goals achievement (Erić, Živković, 2006).

The strategy of targeting inflation has applying for a long time and has been the monetary policy regime accepted by many countries (Milenković, Kalaš, 2020; Ilić et al., 2022). It represents a consequence that in some developed market economies

such as Scandinavian countries, USA, United Kingdom, Austria, Spain...haven't been achieved the expected results by implementing a strategy of monetary aggregates' strategy (Tešić et al., 2021; Krstić et al., 2019).

The inflation as an indicator of the situation in economy shows the time delay of at least 18 months. At the same time, this is the greatest difficulty in conduction of the monetary policy considering the modern economic conditions, which are becoming more complicated and unpredictable, more susceptible to various economic factors (Andrić, 2021). Critics of economic theorists, which were directed to the strategy of targeting inflation, were referred mostly to delay in finalization, excessive rigidity of the strategy, a real possibility in increasing fluctuations in production, increased exposure to currency shocks, as well as weak and slow economic growth (Bungin, 2014).

Many economies, the leading ones at the most, have experienced in last two years an unprecedented level of monetary and fiscal expansion, planned to encourage the economic activity weakened by the pandemic. Similar to the previous recessionary episodes, there were made conditions for the emergence of a new recession – supply side problems (excessed demand, supply problems), financial turbulences (over indebtedness, growth of interest rates) and strong turns in economic policy. Due to everything previously mentioned, the IMF and the World Bank have revised their economic growth forecasts in 2023, in terms of their reduction (Kovačević, Stančić, 2022).

Situation and perspectives of the Serbian agricultural sector

Serbia realizes the unfavourable macroeconomic results compared to the Central and Eastern Europe countries, regardless to a relatively low level of FDI. However, a total share of investments in GDP is significantly under the necessary 25% for fast and sustainable economic growth. It implies to insufficient public and especially domestic economic investments, which furthermore leads to a business climate in the environment in which companies do business. Corruption represents a large limiting factor for the country development, and the consequences for the economy are unfathomable, especially in long-term sense. It causes a lack of resources in every area financed from the budget, ending with education and research-developmental activities that should provide in perspective a competitive advantage of countries on the international market.

Table 1. Macroeconomic indicators

	2015	2016	2017	2018	2019	2020	2021
GDP growth rate (%)	1.8	3.3	2.1	4.5	4.3	-0.9	7.5
Export of goods and services (in billion euros)	15.7	17.4	19.3	21.2	23.3	22.3	28.6
Import of goods and services (in billion euros)	18.6	19.6	22.3	25.3	28.0	26.4	33.1
International trade deficit (in billion euros)	-2.9	-2.2	-3.0	-4.1	-4.6	-4.1	-4.5
FDI (in billion eur)	1.8	1.9	2.4	3.2	3.6	2.9	3.7

	2015	2016	2017	2018	2019	2020	2021
Public debt (% GDP)	71.2	6.8	58.7	54.4	52.8	57.8	57.1
Fiscal deficit/surplus (% GDP)	-3.5	-1.2	1.1	0.6	-0.2	-8.0	-4.1
Unemployment rate (15 +)	18.9	16.4	14.5	13.7	1.,2	9.7	11.0
Inflation (end of a period)	1.5	1.6	3.0	2.0	1.9	1.3	7.9
Reference rate of the NBS (end of a period)	4.5	4.0	3.5	3.0	2.3	1.0	1.0
Gross investments (% of GDP)	17.0	17.1	17.7	20.0	22.5	21.4	23.1

Source: Statistical Office of the Republic of Serbia, Statistical Yearbook of RS, 2022, National Bank of Serbia, 2022

Data in table no.1 show that Serbia had the GDP growth, but insufficient for reducing the difference in development in regard to the EU country members or other developed countries. In an overall observed period was realized an international trade deficit, i.e. import higher than export, which provokes many other negative consequences on the total development and the competitiveness of a country. Public debt still has a high share in relation to GDP. At the end of 2021, the inflation has achieved the level of 7.9%, which was a signal of its acceleration in a period to come.

In most of countries, the agricultural production has been made significantly difficult by insufficient approach to financial resources. It is often realized in a vicious circle of low incomes, insufficient savings and low investments, which unconditionally leads to the dependence on a state aid. Most of farmers have no access to the financial funds in order to modernize and increase their production. On the other hand, there should be taken into consideration that financing through financial institutions hasn't always been easy. Many financial intermediaries work in highly competitive environment, and therefore, when approving loans to an agricultural sector, they take care of their repayment possibilities (Sogo-Temi & Olubiyo, 2004, pp. 101- 116).

Traders (middlemen) profit from the prices increase, and the least profit manufacturers (the example of raspberry, etc.), in the overall chain the least profit direct manufacturers, farmers. There is no serious and stable, long-term agrarian policy that should provide the stability and protection of domestic market, while manufacturers, and in the second instance, consumers – population and domestic processing industry benefit from the budget subsidies. We shouldn't export raw food of which benefit others.

Today, in the field of agriculture (as well as in other activities) dominate the agri-food conglomerates organized as the multinational companies or the regional monopolies and oligopolies. There comes to a convergence, i.e. a vertical integration in which these organisations control industry and eliminate competition, since they determine all aspects of a market. An extended arm of these processes is big shopping centres, which remove the small traders' competition by a „social dumping". In this way were bypassed the free market principles, and a globalist period has brought low economy growth rates and high rates of unemployment (Aničić et al., 2016).

The domestic market belongs to a category of small and underdeveloped markets in which there are no conditions for a propulsive economy and the development of enterprises according to global standards. Therefore, it is necessary to redefine the target markets, create a structure of supply in accordance with the consumers' requirements and adjust the strategy in order to gain and maintain a competitive advantage.

Natural resources and the environmental protection are of an utmost importance for the current and future generations, and this is the reason why enterprises in the field of agriculture should adjust their development to the principles and goals of the sustainable development. This adjustment, in long-term sense, can slow down an economic growth, but in long-term sense, it provides better effects, since it results in economic growth, as well as in better quality of life of the population. Therefore, the preservation of nature and its resources imposes itself as a primary aim of all developmental efforts, ahead of all other production, economic and regional aims (Pokrajac, 2009).

The significance of agriculture in the EU can be observed through several data, which illustrate its role in this community's economy. The agricultural and food industry ensure over 15 million work places in the EU, i.e. 8.3% of all employees of the Union. It is an average size for all EU, which significantly vary from country to country. In so-called „old" EU members (15 industrially developed countries of the West Europe), the average size is 4%, while in „new" EU members (Romania, Bulgaria, Slovakia, Hungary) more than 12% of the total manpower is engaged in agriculture and food industry (Vapa-Tankosić, Stojsavljević, 2014).

The agricultural production participates in the European countries' GDP with 2-3%, but in countries like Bulgaria and Romania, it can participate up to 10% of the national GDP. In 2008, a total value of production in agricultural sector was assessed at 635 billion euros (European Commission, 2012).

The vision of agricultural development and rural areas, according to the strategy, foresees that in 2024, the agriculture in the Republic of Serbia will be a sector that will develop on knowledge, modern technologies and standards, offering the innovative products to the domestic and foreign markets, and a sustainable and stable income to manufacturers. The goal is as well to manage the natural resources, environment and cultural heritage of rural areas in accordance with the principles of sustainable development, in order to make rural areas an attractive place for young people and other residents of rural areas to live and work.

Structural changes in Serbian agriculture have appeared as a consequence of different external factors (globalization, liberalisation, technological progress, climate changes, limited opportunity in using natural resources, demographic changes...) and internal factors (size of agricultural husbandries and a sector structure, sources of productivity growth and use of technology, knowledge and information...). Regardless to numerous difficulties that accompany agriculture in an entire transitional period, this sector realizes the positive foreign trade results and contributes to the reduction of a total international trade deficit.

Table 2. Production of agricultural products and services in prices of production in a current year, 2015-2021 (in millions of RSD)

	2015	2016	2017	2018	2019	2020	2021
I Production of goods and services	534,779.5	589,817.8	543,746.5	589,704.3	605,291.2	667,854.8	724,332.4
1. Production of agricultural products	520,965.6	574,817.9	529,890.4	574,703.9	589,978.3	651,631.7	707,213.2
1.1. Plant production	351,927.4	419,400.1	357.056,3	398,513.5	414,528.6	473,693.3	544,202.2
1.2. Livestock production	169,038.2	155,417.8	172,834.0	176,190.4	175,449.7	177,938.3	163,011.0
2. Agricultural services	13,813.9	1,.999.9	13,856.1	15,000.5	15,313.0	16,223.2	17,119.2

Source: Statistical Office of the Republic of Serbia, Statistical Yearbook of RS, 2022

In table 2, we can see that the total agricultural production in 2021 was increased in regard to 2015 for 36%, but the increase was a result of the plant production increase of 54%, while the livestock production in 2021 was reduced relative to the initial year 2015. This speaks enough on the unfavourable trends in the field of livestock production and its stagnation and decline, which is mostly caused by inadequate agricultural policy and unreasonably high imports, primarily of meat from foreign countries. The primary livestock production, by its structure, reflects in mostly fragmentized agricultural husbandries. In a total value of agricultural production in 2021, the plant production had participated with 68.4%, and the livestock production with 31.6%.

The livestock development of Serbia, beside the economic and financial limitations, has facing serious barriers in a process of the continuity of animal breeding for a long time. Nowadays, the livestock production has been on exceptionally low developmental level, although it has a significant interest for the economic development of the Republic of Serbia. The expected results through forming the sustainable and efficient livestock production can achieve a high level of these products' competitiveness on other markets too, which would contribute to the GDP increase, provide stability in the production of animal origin food, and satisfy the consumers' needs in terms of quality and food safety.

On an export side, there are big opportunities for improving their structure in terms of a greater share of the final processing products with a higher added value in regard to the primary products. It is characteristic for import that some dubious quality and lower price products have often been imported, although Serbia has production surpluses

on the domestic market (meat, milk, maize, some products in the field of vegetable growing, etc.). According to data of the Serbian Chamber of Commerce, in the structure of agricultural production value 70% origin from the plant production, and 30% origin from the livestock production.

According to the Serbian Business Registers Agency data, a sector A – Agriculture, Forestry and Fishing has realized positive business results in 2021, which have been increased in regard to the previous year 2020 in the most important segments - table no.3. According to data, it can be concluded that a negative result in the financing field had significantly increased in regard to the previous year, even 64.7%. Also, the results show that one part of enterprises in this sector have operated at a loss, but in a debit amount there have been realized a positive net result for an entire sector of 11,330 million RSD, which had represented increase of 51% in regard to 2020.

Table 3. Structure of income, expenses and business results of a sector A – Agriculture, Forestry and Fishing (in millions of RSD)

Category of results	Amount	Index
Business incomes	422,021	110.7
Business expenses	402,838	110.4
Business result	19,183	116.9
Financial income	1,849	69.0
Financial expenses	4,862	107.9
Result from financing	-3,013	164.7
Net gain	24,705	127.4
Net loss	13,375	112.5
Net result of the sector	11,330	151.0

Source: Serbian Business Registers Agency, 2022

In accordance to the Serbian Chamber of Commerce (2022), the foreign trade exchange of agriculture and food industry between Serbia and world was amounted more than 5.7 billion euros, from January to September 2022, which represents the growth of over 20% compared to the same period in 2021. Export of goods was amounted 3.6 billion euros, as an increase of 15.4% compared to the same period last year. An export share of agriculture and food industry in a total Serbian export in this period was 17.8 %. At the same time, there was also increased import for 29% in regard to the same period last year, and a share of agriculture in a total export was 7.7%. The most important foreign trade partners of Serbia in export in this period were the EU countries, where there was sold more than a half of agrarian goods (51.4%), the CEFTA region countries, the Russian Federation, etc. In this period, a foreign trade surplus of over 1.4 billion euros was realized in the exchange of agri-food products.

Generally observed, the agriculture in future will be exposed to the requirements of increasing food production in the world. In addition to this requirement, it is expected that the agriculture contributes to a general economic development and poverty reduction, and face with the increased competition for an alternative use of limited land

and water resources, also to adopt to climate changes, and give their contribution to the biodiversity preservation and the renewal of sensitive ecosystems, etc. The answer to these requirements will be more efficient with coordination of private and public sectors, through the public-private sector projects, by the association of manufacturers, etc.

In time to come, the economic policy has to create equal conditions for domestic and foreign investors, which aim to invest in economic development of Serbia. The state should have an impact on the increase of domestic and foreign investments and private sector, by increasing public investments in infrastructure. In such conditions, for domestic enterprises would also be easier to invest, regardless to a relatively modest own funds. The state should support, by its economic policy, the incentive factors for investments, and reduce the influence of limiting factors. Numerous factors, which help in this achievement, are an import substitution, stimulating export, credit and monetary policy, predictable business conditions, stable exchange rate, controlled inflation, etc.

Conclusion

Many economies, the leading ones at the most, have experienced in last two years an unprecedented level of monetary and fiscal expansion, planned to encourage the economic activity weakened by the pandemic. The interest rates were reduced to unprecedented low levels, government spending was directed to various forms of assistance to the economy and the population, which caused issuing an enormous amount of debt for their financing. Although these moves have contributed to recovery after the corona virus (5.7% growth of the global GDP in 2021), the world economy has becoming "overheated" – burdened by high inflation, excessed demand, over indebtedness and with spent capacities and a lack of fiscal space, in one word – unready for the forthcoming challenges on the geopolitical level, and have moved to a sphere of economy. The biggest challenges the world economy is facing with are the acceleration of inflation, the interest rate increase, energy crisis, interruption of the global supply chains, geopolitical risks, etc.

The high inflation hit the agricultural sector, while the prices of food, together with the energy sources, were significant for the population standard, especially in developing countries. Besides the food prices growth, there came to a shortage of products which Serbia had traditionally exported, and had a comparative advantage in their production. Traders (middlemen) profit from the prices increase, and the least profit manufacturers (the example of raspberry, etc.), in the overall chain the least profit direct manufacturers, farmers. There are fewer and fewer people in villages engaged in agriculture, and we are still not capacitated to produce more (and better quality) with much less people. Domestic manufacturers, especially the fragmented family farms, were kicked out by an indiscriminate import. This is all the consequence of the absence of the economic/agrarian strategic approach in previous period. The economic and agrarian policy in the future must create *inter alia* the equal conditions for domestic and foreign investors, which aim to invest in the country's economic development, while agriculture is indisputably one of the key economic branches in our country.

Conflict of interests

The authors declare no conflict of interest.

References

1. Agencija za privredne registre (2022) Godišnji izveštaj o poslovanju privrede u 2021. godini, Beograd (Serbian Business Registers Agency (2022) Annual report on business operations in 2021, Belgrade)
2. Andrić, Đ. (2021) Primena i efekti ciljanja inflacije kao strategije Narodne banke Srbije, DEB, Ekonomski vidici, XXVI (2021), Br. 3-4, s 271-287 ISSN 0354-9135 UDK-33 COBISS.SR-ID 116154887 [*in English:* Andrić, Đ. (2021) Application and effects of inflation targeting as a strategy of the National Bank of Serbia, DEB, Ekonomski vidici, XXVI (2021), No. 3-4, pp. 271-287 ISSN 0354-9135 UDK-33 COBISS.SR-ID 116154887]
3. Aničić, J., Vukotić, S., Krstić, S. (2016) The strategic aspects and results of agriculture development in Serbia in the transition period, Economics of Agriculture, Vol. LXIII, No. 1, p. 175-189
4. Ball, L., Sheridan, N. (2003) *Does Inflation Targeting Matter?* IMF Working Paper, WP/03/129
5. Bernanke, S. Ben. (2004) The Great Moderation. *BIS Review*
6. Blanchard, O., Dell Ariccia, G. (2010). *Rethinking Macroeconomic Policy.* IMF Staff, Position Note, SPN/10/03
7. Blanchard, O., Dell'Ariccia, G., Mauro, P. (2010) Rethinking Macroeconomic Policy. *Journal of Money, Credit and Banking Supplement to Vol. 42. No 6*
8. Blinder, A. S. (2002). *Through the Looking Glass: Central Bank Transparency.* CEPS, Working Paper No. 86
9. Bungin, S., (2014) Transmisioni mehanizam monetarne politike u zemljama istočne i jugoistočne Evrope, sa posebnim osvrtom na Srbiju, Ekonomski fakultet, Kragujevac [*in English:* Bungin, S., (2014) The transmission mechanism of monetary policy in the countries of Eastern and Southeastern Europe, with special reference to Serbia, Faculty of Economics, Kragujevac]
10. Djukić, M., Momčilović, J., Trajčev, Lj. (2010) Model za srednjoročne projekcije Narodne banke Srbije, Narodna banka Srbije, Beograd [*in English:* Djukić, M., Momčilović, J., Trajčev, Lj. (2010). Model for medium-term projections of the National Bank of Serbia, National Bank of Serbia, Belgrade]
11. Erić, D., Živković, B. (2006) Monetarna ekonomija, bankarstvo i finansijska tržišta, Data Status, Beograd [*in English:* Erić, D., Živković, B. (2006). Monetary economy, banking and financial markets, Data Status, Belgrade]
12. European Commission (2012) *Agriculture and Rural Development,* available at: http://ec.europa.eu/agriculture/index_en.htm

13. Goodfriend, M. (2007) How the World Achived Consensus on Monetary Policy. *Bureau of Economic Search Working Paper Series*

14. Ilić, V., Mihajlović, M., & Knežević, M. (2022). The role of social entrepreneurship in modern business conditions. *Oditor, 8*(2), 75-90. https://doi.org/10.5937/Oditor2202074I

15. Katić, N. (2022) Globalna politika i ekonomija u 2022: Inflacija krupnih reči i sebičnih interesa, Internet stranica RTS [*in English:* Katić, N. (2022) Global politics and economy in 2022: Inflation of big words and selfish interests, RTS website]

16. Kovačević, M., Stančić, K. (2022) Neki aspekti eventualne recesije u 2023. godini – čemu nas uči istorija, Makroekonomske analize i trendovi, Ekonomski institut i Privredna komora Srbije, Beograd [*in English:* Kovačević, M., Stančić, K. (2022) Some aspects of a possible recession in 2023 - what history teaches us, Macroeconomic analyzes and trends, Economic Institute and Serbian Chamber of Commerce, Belgrade]

17. Krstić, S., Stanković, M. N., Milenković, N.P. (2019) Model ofšor bankarskog poslovanja u savremenim uslovima, Vojno delo, 71(2), str. 244-253 [*in English:* Krstić, S., Stanković, M. N., Milenković, N.P. (2019). A model of offshore banking operations in modern conditions, Vojno delo, 71(2), p. 244-253]

18. Larson, A., Zetterberg, J. (2003) *Does Inflation Targeting Matter for Labour Markets? - Some Empirical Evidence.* FIEF Working Paper Series, No. 191

19. Lavrač, V. (2002) Monetary, Fiscal and Exchange Rate Policies From the Viewpoint of the Enlargement of the Eurozone: Survey of the Literature. *Institute for Economic Research Working Paper No. 14.*

20. Marjanović, G., Mihajlović, V. (2012) Savremena analiza monetarne politike primenom IS-PC-MR modela, Ekonomske teme, br. 4, str. 465-485 [*in English:* Marjanović, G., Mihajlović, V. (2012) Contemporary analysis of monetary policy using the IS-PC-MR model, Economic Topics, no. 4, p. 465-485]

21. Mishkin, S. F. (2006) Monetary Policy Strategy: How We Did Get Here. *National Bureau of Economic Search Working Paper Series*

22. Milenković, N., Kalaš, B. (2020) Banke versus fondovi rizičnog i privatnog kapitala – supstitut ili komplement? Kultura polisa, 16 (41), str. 653-663 [*in English:* Milenković, N., Kalash, B. (2020) Banks versus venture and private capital funds – substitute or complement? Culture of Polis, 16 (41), p. 653-663]

23. Mollick, A.V., Torres, R.C., Carneiro, F.G. (2008) *Does Inflation Targeting Matter for Output Growth? – Evidence from Industrial and Emerging Countries.* World Bank Policy Research Working Paper No. 4791

24. Narodna banka Srbije, Makroekonomska kretanja u Srbiji, 2022. [*in English:* National Bank of Serbia, Macroeconomic trends in Serbia, 2022]

25. Pantić, N., Mikulič, K., & Lekovič, M. (2022). The influence of claims payments on the investment portfolio of insurance companies. *Oditor*, *8*(3), 42-71. https://doi.org/10.5937/Oditor2203042P

26. Privredna komora Srbije (2022) Udruženje za biljnu proizvodnju i prehrambenu industriju Privredne komore Srbije, Beograd [*in English:* Chamber of Commerce of Serbia (2022) Association for Plant Production and Food Industry of the Serbian Chamber of Commerce, Belgrade]

27. Rakić, S., Adamović, V., & Špiler, M. (2021). Challenges and directions of developing business communication on the global market. *Oditor*, *7*(3), 67-103. https://doi.org/10.5937/Oditor2103067R

28. Republički zavod za statistiku, Statistički godišnjak Republike Srbije, 2022. [*in English:* Republic Institute of Statistics, Statistical Yearbook of the Republic of Serbia, 2022]

29. Sinclair, P. (2003) The Optimal Rate of Inflation: An Academic Perspective. *Bank of England Quarterly Bulletin,* 43 (3): 343-351

30. Strategija poljoprivrede i ruralnog razvoja Republike Srbije 2014-2024. godine, *"Sl. glasnik RS", br. 85/2014* [*in English:* Agriculture and Rural Development Strategy of the Republic of Serbia 2014-2024. year, "Official Gazette of RS", no. 85/2014]

31. Tešić, R., Mihajlović, M., Jeremić, D., & Ilić, Đ. (2021). Strategija diverzifikacije kao nužnost opstanka, rasta i razvoja proizvodnih preduzeća, Akcionarstvo, 27(1), 27-39.

32. Vapa-Tankosić, J., Stojsavljević, M. (2014) EU Common Agricultural Policy and Pre-accession Assistance Measures for Rural Development, *Economics of Agriculture,* Vol. 61, No. 1, pp. 195-210

INTERNATIONAL STANDARDS AND AUTHORIZATIONS OF LABOR INSPECTION IN AGRICULTURE IN CASE OF TERMINATION OF EMPLOYMENT RELATIONSHIP

Vladimir Radovanović[1]

**Corresponding author E-mail: radovanovic.vladimir95@gmail.com*

ARTICLE INFO

Review Article

Received: *25 February 2023*

Accepted: *20 March 2023*

doi:10.59267/ekoPolj2301323R

UDC 006.323:331.108.2

Keywords:

labor inspection, international standards, termination of employment, agriculture

JEL:*J43, J80, K31, K42*

ABSTRACT

Agricultural work is the oldest form of work, but the rights of agricultural workers are still not sufficiently protected, especially if their legal position is compared to that of employees in other branches of the economy. One of the tools for improving the legal protection of farmers is through the work of labor inspection, as an important element of control over the application of the relevant legal regulations. Even though the legal status of employees in agriculture has seemingly experienced some normative progress, the situation is unfortunately still far from being ideal, especially regarding the protection of their rights in the employment relationship and the manner in which those rights are exercised in practice. In this regard, this paper will address universal international standards in this area and the compliance of domestic Serbian legislation with the relevant conventions and recommendations of the International Labor Organization. Additionally, a particular focus will be placed on protecting agricultural workers against illegal dismissal.

Introduction

Labor inspection is a vitally important instrument of state supervision of the application of labor-related regulations. It is through the operation of labor inspection that working conditions are improved and the protection of rights from the employment relationship is ensured. The employment relationship is characterized by the subordination of the employee to the employer, so in order to protect the rights of employees, there is a need for state to intervene through the action of the labor inspection. The labor inspection is a powerful and quality instrument for the effective implementation of policies in the field of labor and safety at work (Rozić, Mehmedović, 2019: 848). In addition to the direct supervision of the application of regulations in the field of work, administrative protection of the right of employees to legal and dignified work is achieved through

1 Vladimir Radovanović, PhD student, University of Belgrade, Faculty of Law, Bulevar Kralja Aleksandra 67, 11000, Belgrade, Serbia, phone: +381644686331, E-mail: radovanovic.vladimir95@gmail.com, ORCID ID (https://orcid.org/0000-0003-1085-8388)

inspection supervision (Marković, 2016: 216). Labor inspection actions serve both as a preventive and corrective tool. The preventive role is reflected through the control of subjects on the labor market in a country, supervision over the implementation of laws and other acts regulating labor relations and working conditions, and through monitoring the actions of employers and employees in their application. Simultaneously, the corrective measures of labor inspection are rendered especially in the possibility of issuing an injunction for the elimination of observed irregularities. Those powers also play a certain retributive role, e.g. when sanctioning employers due to non-compliance with the rules and standards of the labor market that are prescribed by the state with its imperative norms. Where necessary, and often as a last resort, inspectors can use their enforcement powers and take formal enforcement action to achieve compliance with the law (Casale, Fasani; 2012: 3). These powers also affect the position of employees, especially in the case of termination of employment because they affect the postponement of the execution of the employer's decision on the termination of the employment contract by order of the labor inspector, which will be discussed in more detail in this paper.

Materials and methods

By applying the normative method, we observe the accordance between international standards on labor inspection and compliance with domestic legislation. The emphasis will be on inspection supervision in the field of agricultural activity. By comparing domestic regulations in the realm of labor inspection, we will determine labor inspection's concept of organization and its powers. The work is based on the analysis of positive regulations, as well as theoretical concepts of labor inspection.

International Standards on Labor Inspection in Agriculture

When we talk about international standards in the field of labor inspection, we should first mention ILO Convention No. 81 on labor inspection in industry and trade from the year 1947. The task of labor inspection is hereby defined to ensure the implementation of legal provisions related to working conditions and the protection of workers while performing their work, providing professional information and advice to employers and workers on the most effective ways of complying with legal regulations, as well as informing the competent authority about deficiencies and abuses. In Article 3 of Convention No. 81, the contracting states are called upon to protect all categories of workers, including vulnerable groups of workers. With the aforementioned convention, the labor inspection was placed under the supervision and control of the central authority, from which the conclusion can be drawn that its orders and instructions have to be obeyed. However, the aforementioned provision is considered to be the cause of certain problems due to its interpretation and application, especially about the organization of labor inspection and its relationship with other authorities. Moreover, Convention No. 81 urges the state to ensure a sufficient number of inspectors, their training and other conditions conducive to successful work. The powers of inspectors are thus prescribed -

they are allowed to come freely and without prior notice at any time of the day (or night) at the workplace that is the subject of supervision. Furthermore, inspectors can issue orders with the aim of eliminating irregularities and immediate danger to the health of workers. The mentioned provisions of the Convention represent a great step forward in terms of improving rights from the employment relationship, and working conditions, through the supervision of labor inspection. But this convention refers primarily to workers in industry and trade, for which reason the need for a new convention that will pay special attention to workers in agricultural activities has emerged.

Therefore, related to the topic of this paper, the ILO Convention No. 129 on labor inspection in agriculture, which was adopted in Geneva in 1969 and ratified by Yugoslavia in 1975 (Official Gazette of SFRY No. 22/75), stands out as the most important. Convention No. 129 furthermore confirms the provisions of the above-mentioned Convention No. 81 stating a special adaptation to the working conditions in the field of agriculture, bearing in mind the specificity of that field of work. Namely, the adoption of this convention was conditioned on the fact that the general regulations in this area are insufficient to protect farmers' rights and that there is a need to adapt the normative standards to the working conditions in that area of economy, as well as to the working hours of agricultural workers and the distinctly seasonal nature of agricultural work. It is particularly important to note that Convention No. 129 enables countries, that have ratified it, to entrust labor inspectors with advisory or control functions in their national laws, in order to control the living conditions of agricultural workers and their families (Article 6, paragraph 2). This shows the intention to improve not only the working conditions, but also the living conditions of farmers and their household members through the actions of labor inspection. Furthermore, the Convention prescribes the need for the work of inspectors to be such that they are guaranteed continuity in their work, and "independence from the change of government and inappropriate external influences" (Article 8, paragraph 1). With the mentioned provision, significant progress was made in the field of guaranteeing the impartiality of labor inspectors, their professionalism, expertise, and the prohibition of other authorities to interfere in the decisions of labor inspectors. Bearing in mind the large number of agricultural enterprises and employees in that field, the Convention stipulates the obligation of states to provide a sufficient number of inspectors in order to effectively supervise the subjects of work. Inspectors are authorized to undertake measures aimed at eliminating defects in installations or in the method of work in agricultural entities. Authorization related to health protection and safety at work is especially important, through the issuance of an order for the modification of agricultural installations, tools and plants. Also, the inspector can take measures with immediate executive power, which can even go so far as to order the suspension of work in the event of an imminent danger to health and safety. All these measures can also affect the improvement of working conditions, since labor inspectors are the only public law entities that have access to all workplaces (Kovačević, 2022b:17). Observations made by analyzing the text of the Convention show that preventive measures exist, such as visiting workplaces and offering advice and instruction to employers. In the agricultural sector, among other

preventive activities, labor inspectors also organize: field shows and training courses in safe cutting methods in the event of specific threats (trees felled by storms or snowfalls) in some forest district offices; education in rural areas targeting children and adults on the most frequent work-related hazards; the organization of inspection stands and consultation points on technical safety at work during mass rural events, such as machine shows and exhibitions; the publication and distribution of brochures, guidebooks and leaflets; and the provision of information to the public through newspapers, radio and television (Casale, Fasani, 2012: 3). The adoption of Convention No. 129 enables the extension of inspection supervision to all agricultural workers, including workers who have not established an employment relationship (Kovačević, 2022b: 28). Inspection powers include the right to enter the employer's premises under supervision without prior notification, and this is one of authorities that particularly stands out. Also, the inspector can conduct various examinations, tests, analyses of products and samples, and the inspector has the right to demand the submission of all business books and registers by the employer. The question of how to organize inspections can be solved in different ways, using different models. In Article 16 of the Convention, it is defined that the labor inspection in agriculture could be carried out by, for example, a labor inspection authority responsible for all sectors of economic activity; a labor inspection body that would ensure internal functional specialization, through appropriate training of inspectors who should perform their functions in agriculture; a labor inspection body that would ensure internal specialization by creating a professionally capable service whose officials would perform their functions in agriculture; a specialized service for inspection in agriculture whose work would be supervised by a single central authority that was granted the same prerogatives regarding the inspection of work in other areas, such as industry, transport and trade. States are left with the right to choose between the above solutions, thus recognizing national differences and peculiarities. For example, in some countries, labor inspectors cannot impose fines on their own, but can only file misdemeanor charges or notify relevant ministries to file such charges (Rozić, Mehmedović, 2019: 860). This possibility was foreseen by Convention 129, which in Article 23 stipulates that if labor inspectors are not authorized to initiate misdemeanor proceedings on their own, then they must have the authority to submit reports on misdemeanors to state authorities competent to initiate such proceedings. Different models of labor inspection, meanwhile, reflect the differences that exist between countries in terms of the concept of the state and its relationship with society (Kovačević, 2022b: 6). In the ILO conventions no. 81 and 129, therefore, the general principles and universal international framework of importance for the position, structure and functioning of labor inspection are confirmed (Albracht, 2005b: 69).

In addition, ILO Recommendation No. 133 on labor inspection in agriculture from 1969, which was adopted along with Convention 129, is also important, and which supplements it, among other things, with the possibility of recognizing the authority of labor inspectors to participate in the role of conciliator/arbitrator in the resolution of labor disputes between agricultural workers and their employers. Article 3, paragraph 1 of the Recommendation,

defines that the functions of labor inspectors in agriculture should not include the function of conciliator or arbitrator in procedures related to labor disputes. However, if there are no special bodies in agriculture for this purpose, inspectors can be called upon as conciliators, as a temporary measure. Therefore, this provision creates a possibility for the labor inspector to act as a mediator in resolving disputes in this branch. Such a provision represents a step forward in relation to Convention No. 129 which does not foresee the possibility of conciliation by the inspector. Namely, conciliation is the preferred out-of-court way of resolving a labor dispute, which speeds up and facilitates the procedure for resolving disputed issues. And bearing in mind that the process of conciliation and arbitration is expanding in all branches of the economy, there is no reason why it should not be applied in the field of agriculture as well. Apparently, more efficient and effective protection of the rights of agricultural workers can be created by increasing the number of conciliation and arbitration procedures in agriculture. Conciliation is also advantageous from the employer's point of view, because it lowers the costs of the procedure and speeds up the resolution of the dispute. This solution does, however, present a peculiarity. According to Recommendation 133 (in paragraph 3 of Article 3), if the labor inspector is temporarily engaged in the function of conciliator, the competent authority should take measures with the aim of having the labor inspector as soon as possible released from these functions, so that he is able to devote himself to his basic supervisory function (Stojšić, 2013: 67). Safety and health at work should also be protected by labor inspectors in cooperation with employers and employees. This serves to emphasize the importance of social dialogues, as one of the most effective ways to regulate the field of safety and health at work and create a healthy working environment (Stojšić, 2013: 67). In addition, Recommendation No. 133 foresees the employer's obligation to carry out prior consultations with the labor inspection, when setting up a plant, as well as acquiring new materials and substances. As a result of the previously mentioned provision, labor inspection becomes more actively involved in the supervision of various activities. This is extremely important, especially for employers who procure and provide hazardous substances or work tools that they have not used in the production process so far (Stojšić, 2013: 67-68).

Convention no. 81 together with Convention no. 129, and their accompanying recommendations, established the basis for the labor inspection system (Casale, Fasani, 2012: 1). Despite the differences in the field of agriculture which exist between states around the world, the states retain the right to determine how the inspectorate is organized, with a lot of flexibility. It is up to each state to decide the method of constructing, organizing, and operating labor inspections that most suits its national circumstances, legal tradition, and other factors (Kovačević, 2022b: 15). Based on this, the conclusion can be drawn that the mentioned international standards have made a shift in the organization and operation of the labor inspection, but that it is up to the states to continue work on improving the protection of labor rights through inspection supervision. Through their national legislation, countries have to adapt the implementation of international standards to their labor market and economic situation, including that in agriculture.

ILO Convention No. 150 on labor administration should also be mentioned, which refers, among other things, to the organization of labor inspection, as part of state administration in a broader sense. As a result of Article 7 of the Convention, it is recommended that labor administration functions, including labor inspections, be extended to groups of workers who are not employees based on national law, such as tenants and self-employed persons. This shows the intention to establish stronger inspection supervision in the agricultural sector, which achieves a greater degree of legal security for agricultural workers, but also for their families. This is especially important due to the fact that private entrepreneurs, agricultural holdings and other organizational structures are increasingly used as a form of business, and at the same time that the natural person, who is the bearer of these activities, does not have sufficient knowledge in the field of work, nor hires persons who have such knowledge, which often leads to endangering the basic rights of employees or persons engaged in work, and even endangering their health or life (Stojšić, 2013: 349).

Powers of the labor inspector in Serbia in case of termination of the employment contract

When we talk about inspection supervision in Serbia, it should be noted that the Labor Law/ Labour Law/Employment Act ("Off. Herald of RS", No. 24/2005…13/2017-Decision of the CC, 113/2017 and 95/2018) in Article 268 stipulates that the supervision of the implementation of laws, other regulations on labor relations, general acts and labor contracts, which regulate the obligations and responsibilities of employees, is carried out by the labor inspection. A strict linguistic interpretation of the provision means that labor inspectors are competent only with regard to the application of legal regulations to employees, not to employed persons who work outside the employment relationship (Brković, Urdarević, 2020: 258). Although in a large number of cases the inspection also reacts when it comes to contracts outside the employment relationship, it seems that it is more about an act of good will of the labor inspector or about their discretionary decision, whether to carry out such supervision or not (Brković, Urdarević, 2020: 236). This is precisely what is the source of potential problems for agriculture workers, whose employment status is not always clearly regulated. This can potentially undermine the protection of their rights, when such rights are threatened. What is of paramount importance is the authority of the inspector to order the execution of measures and actions with the aim of eliminating violations of the law. In addition, the inspector is required to submit a report for a committed criminal or economic offense or a request for the initiation of misdemeanor proceedings. However, related to the topic of this paper, the most relevant authority of inspector is the one defined in point 11, article 268a. It states that the inspector can postpone the execution of the employer's decision on the termination of the employment contract, when the right of the employee is clearly violated. Namely, one of the basic rules of Serbian Labour Law implies that an employee cannot terminate his employment relationship against his will, unless there are justified reasons for this regarding the ability and behavior of the employee or the needs of the employer. To be more precise, it is about the concept of justified (valid)

reasons for the termination of the employment contract by the employer, which is built into ILO Convention No. 158 on the termination of the employment relationship at the initiative of the employer, which applies to all employed persons and all employers. The grounds for termination of the employment relationship are further prescribed by domestic laws, and are exhaustively listed. Any termination without legal grounds is illegal, which entails the following consequences: 1) return to work - reintegration, 2) compensation for damage, 3) payment of the corresponding contributions to mandatory social security. Employees generally believe that the employer is obliged to return them to the workplace where they worked until dismissal (Popović, 2020: 137). But, returning to work means returning to the previous job position, and in the event that such a job was terminated, to a job that corresponds to his professional training and abilities (Brković, Urdarević, 2020: 236). This is supported by the verdict of the Supreme Court of Justice of Serbia (No. Rev2 1017/2017 of 15.05.2014), that the employer is not obliged to return the employee to the same job that he was performing before the dismissal, based on the decision of the labor inspector, but to assign him to a workplace that corresponds to his professional training, knowledge and abilities, in accordance with his own act of workplace systematization.

Article 271 of the Labour Law stipulates that, if the labor inspector finds that the employer's decision to terminate the employment contract clearly violates the right of the employee, and the employee has initiated a labor dispute, the inspector will postpone the execution of that decision at the employee's request. The inspector's decision, made on this basis, is a type of temporary measure that the labor inspector, as a representative of the administration, takes instead of the court before which the labor dispute is pending (Marković, 2015: 208). That decision can be effective only until the court makes a final, legally binding decision. Otherwise, if the employee's right is not clearly violated, the inspector will reject the employee's request to postpone the termination of the employment contract. By passing the above-mentioned measure, the labor inspector is, at least temporarily, protecting the employee. The Labour Law prescribes the conditions for postponing the termination of the employment contract, which must be fulfilled cumulatively. It is necessary to prove that the employer's decision clearly violated the right of the employee, that the employee initiated a labor dispute and that he submitted a request to the labor inspectorate to postpone the execution of the employer's decision of dismissal (Maričić-Vukotić, 2009: 155). Hypothetically speaking, there may be a situation where the decision on the temporary measure of the court is in conflict with the decision of the labor inspector, made on this basis (Marković, 2015: 208). Bearing in mind that both the court and the labor inspectorate in this situation can make a decision on a temporary measure, deciding on the protection of the employee, it is possible for there to be contradictory decisions, but this has not taken place in practice. On the other hand, what has been noticed is that the employee was able to return to work as a result of both the court and the acting inspector's decisions (Marković, 2015: 208). Of course, what is a potential problem in the Labour Law with such a temporary measure, is the need for an "obvious violation of the employee's rights". Such a

definition is unclear at first glance, and subject to wide interpretation, depending on each individual situation. What does "obvious violation" mean? What kind of violation of rights is obvious enough to require and justify the intervention of the state in the form of a decision of the labor inspector? The employee's right is clearly violated, when it is visible that a violation of rights has occurred, that is, when the conclusion of a violation of rights can be reached without extensive proof, and it is almost certain that the court will annul the employer's decision due to the violation of the employee's rights (Marković, 2015: 208). Therefore, an obvious violation would exist when there is a high probability that both authorities will come to the same decision on this issue. The violation of rights must be gross, that is, it must have had a significant impact on the legality of the decision made (Marković, 2015: 209). Of course, whether the inspector initially made a correct decision will be known in the merits and final decision of the court, which is also a check of the legality of the inspector's work. When the labor inspector makes a decision to postpone the employer's termination of the employment contract, the employer must act on that decision and return the employee to work, and register him again for mandatory social insurance. The employer can file a complaint, but it does not delay execution. If the employer does not act in this way, then he can bear the consequences, because he commits a violation, for which he can be fined. So, when the inspector issues an order, it is the employer's obligation to act on them, within the defined deadline, otherwise he may bear further retributive consequences. In protecting employees' rights at work, the labor inspector's administrative procedure is most effective due to its speed and efficiency (Maričić-Vukotić, 2009: 158). Usually only a few days pass from the moment a request is submitted, to executive supervision and taking action (Maričić-Vukotić, 2009: 159).

Results and Discussion

Of all forms of economic activity, agriculture is the one in which the work of labor inspection is particularly important, especially when suppressing the shadow economy, illegal and undeclared work. According to one commonly used definition, undeclared work includes all currently unregistered economic activities that would contribute to the officially calculated gross domestic product, if such activities were recorded (Schneider, Williams, 2013: 19). According to the data of the Statistical office of the Republic of Serbia, based on the labor force survey conducted every year, the rate of total informal employment in the third quarter of 2022 was 14% of the total number of the working population in Serbia. The rate of informal employment outside agriculture amounted to 7.0%, while the same rate in agriculture amounted to 53.8% (Source: Statistical office of the Republic of Serbia, Labor Force Survey, 3rd quarter of 2022). The phenomenon of de facto work remains a key problem in the field of labor relations with labor inspectors making extensive efforts to introduce this phenomenon into the legal regulation of mutual rights, obligations and responsibilities based on work (Peruničić, 2011: 182-183). Despite all the problems in this field that the labor inspection is facing, there is a noticeable increase in the number of concluded employment contracts and

registered mandatory social insurance, after the inspection was carried out (Peruničić, 2011: 185). Undeclared work is the most prevalent phenomenon in agriculture (including gardening), fishing, and mineral extraction after the construction sector. More than half of all jobs in the non-agricultural sectors of developing countries – over 0.9 billion workers – can be considered informal, and if agricultural workers in developing countries are included, this leads to an estimate of about two billion people (Schneider, Williams, 2013: 79). In addition to illegal work, as a form of engagement without a contract, which is an acute problem in the agricultural sector, there are also problems such as delays in the payment of wages or even non-payment of wages to many employees, especially agricultural workers. Also, unsafe working conditions, non-payment of contributions for mandatory social insurance are frequent occurrences.

Conclusion

By considering the international regulations in the field of labor inspection, which are primarily defined in the ILO Conventions No. 81 and 129, it can be concluded that they enable countries to adapt international standards to their specific national circumstances. On the other hand, it is noticeable that in domestic legislation in Serbia, there is a significant number of laws that regulate the position and powers of labor inspectors: The Labour Law comes first, then the Law on Inspection Supervision, the Law on Administrative Procedure, and the Law on Safety and Health Protection at Work. It can be concluded that, from a normative point of view, domestic legislation is harmonized to a high degree with world standards, as well as that the field of labor inspection in Serbia is regulated in quite detailed legal terms.

But of course, legal regulations are one thing, and their practical application is another. In this field, the challenges remain challenging, taking into account the insufficient number of labor inspectors, the prevalence of undeclared work and the shadow economy. According to the relevant parameters, each employer could be subjected to inspection only once every eight years (Kovačević, Lj., 2022a: 220). In addition, the problem exists in the unclear demarcation of powers between labor inspection and other inspections and supervisory bodies, because in some cases of supervision these powers overlap, which undermines the effectiveness of their work and leads to the waste of the already modest capacities of labor protection in our country (Kovačević, Lj., 2022a: 206). Also, the Labour Law foresees one particularly powerful repressive measure, which is the request to initiate misdemeanor proceedings before the court, by the labor inspectorate, when a violation of the relevant regulations by the employer is determined. However, the Law does not prescribe any deadline for the court to act on the inspector's request. Therefore, it may happen that, despite the timely reaction of the labor inspector, the statute of limitations for the initiation of misdemeanor proceedings still may occur (Kovačević, Lj., 2022a: 180). It should also be borne in mind that, compared to ILO standards, this repressive measure seems insufficient to ensure the effectiveness of labor legislation. In the spirit of ILO standards, labor inspectors can, namely, impose mandatory penalties, as well as initiate (temporary or permanent)

revocation of permits and suspension of enforcement before the competent authorities, and undertake other measures that enable the achievement of the desired goals related to the consistent application of the relevant regulations. Finally, the challenges follow the authorization of the labor inspector to delay the execution of the dismissal decision, with a particular challenge being the determination of the "obvious violation of the employee's rights" standard.

The ideal of inspection is its disappearance, i.e., the achievement of such a level of compliance with laws and other regulations of the subjects of supervision that there is no need for the corrective and repressive function of inspection services (Rozić Mehmedović, 2019: 850). Of course, it is almost unimaginable that such a scenario will ever come true. However, the creation of a society in which inspections will no longer be needed is something to strive for.

Acknowledgements

Acknowledgement to the author's PhD mentor, professor Ljubinka Kovačević, regular professor, University of Belgrade Faculty of Law, who provided significant help during the research.

Conflict of interests

The authors declare no conflict of interest.

References

1. Albracht, G., (2005). Integrated Labour Inspection Systems: The Strategy of the ILO, *Labour Education*, (3-4) https://www.ilo.org/public/libdoc/ilo/P/09707/09707(2005-3-4)67-73.pdf
2. Casale, G., Fasani, M., (2012). International Labour Standards and Guiding Principles on Labour Administration and Labour Inspection, International Labour Office, Geneva: ILO, 1 v. https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---lab_admin/documents/publication/wcms_194389.pdf
3. Kovačević, Lj., (2021), Legal position of seasonal workers in the Republic of Serbia, *Revue de Droit Comparé du Travail et de la Sécurité Sociale*, no. 2021/4, DOI:https://doi.org/10.4000/rdctss.2776 https://journals.openedition.org/rdctss/2776
4. Kovačević, Lj., (2022a). Jedan vek inspekcije rada u Srbiji: Razvoj i aktuelni izazovi, Kaznena reakcija u Srbiji, XII deo, Pravni fakultet Univerziteta u Beogradu [*in English*: Kovačević, Lj., (2022a). A century of labour inspection in Serbia: Development and contemporary challenges, Criminal reaction in Serbia, part XII, Faculty of Law, University of Belgrade]
5. Kovačević, Lj., (2022b). Delotvornost radnog zakonodavstva i uloge inspekcije rada u svetlu standarda MOR, *Strani pravni život,* broj 1/2022 [*in English*:

Kovačević, Lj., (2022b). The effectiveness of labor legislation and the role of labor inspection in the light of ILO standards, *Foregn legal life*, no. 1/2022], Doi: 10.5937/spz66-36661

6. Marković, G., (2016). Najznačajnije novine u propisima o radu i po osnovu rada, Glosarijum, Beorgad [*in English*: Marković, G., (2016). The most significant news in labor regulations and on the basis of work, Glosarijum, Belgrade]
7. Marković, G., (2015). Novine u Zakonu o radu, Glosarijum, Beograd [*in English*: Marković, G., (2015). Novelties in the Labour Law, Glosarijum, Belgrade]
8. Rozić, I., Mehmedović, E., (2019). Specifičnosti vršenja inspekcijskih funkcija u oblasti rada, radnih odnosa i sigurnosti na radu, *Zbornik Pravnog fakulteta Sveučilišta u Rijeci*, vol. 40, br. 2, 847-867. [*in English*: I. Rozić, I., Mehmedović, E., (2019). Specialties of inspection functions performance in areas of work, work relations and occupational safety. *Proceedings of the Faculty of Law, University of Rijeka,* vol. 40, no. 2, 847-867] https://doi.org/10.30925/zpfsr.40.2.8
9. Schneider, F., Williams, C., (2013). The Shadow Economy, Institute of Economic Affairs, London, http://www.iea.org.uk/sites/default/files/publications/files/IEA%20Shadow%20Economy%20web%20rev%207.6.13.pdf
10. Брковић, Р., Урдаревић, Б., (2020). Радно право са елементима социјалног права, *Službeni glasnik*, Beograd, [*in English*: Brković, R., Urdarević, B., (2020). Labour Law with elements of social security law, *Official Gazette*, Belgrade]
11. Маричић-Вукотић, Ј., (2009). Инспекцијска заштита права запослених, Глосаријум, Београд, [*in English*: Maričić-Vukotić, J., (2009). Inspection protection of employees' rights, Glosarijum, Belgrade]
12. Перуничић, П., (2011). Инспекцијски надзор у примени пропписа о раду, у Заштита права из области рада, Глосаријум, Београд *[in English*: Peruničić, P., (2011). Inspection supervision in the application of regulations on work, in Protection of rights in the field of work, Glosarijum, Belgrade]
13. Поповић, М., (2020). Престанак радног односа: Општи режим, Завод за уџбенике Београд [*in English*: Popović, M., (2020). Termination of employment: General regime, Belgrade]
14. NALED, 2019, Angažovanje sezonskih radnika u poljoprivredi, Praktični vodič za primenu Zakona o pojednostavljenom radnom angažovanju na sezonskim poslovima u određenim delatnostima [*in English*: NALED, 2019, Engagement of seasonal workers in agriculture, Practical guide for the application of the Act on simplified work engagement in seasonal jobs in certain industries] (available at: https://www.paragraf.rs/dokumenti/Vodic-Zakon-o-sezonskom-radu.pdf)
15. Министарство за рад, запошљавање, борачка и социјална питања, 2021, Извештај о раду Инспектората за рад [*in English*: Ministry of Labor, Employment, Veterans and Social Affairs, 2021, Report on the work of the Labor Inspectorate] (available at: https://www.minrzs.gov.rs/sites/default/files/2022-04/Izvestaj%20o%20radu%20Inspektorata%20za%20rad%20za%202021.god_..docx, 08.02.2023.)

16. Inspekcija rada i neprijavljeni rad u Evropskoj uniji, Međunarodna kancelarija rada, Ženeva, MOR, 2013. Radni dokument broj 29, 2013. [*in English*: Labor inspection and undeclared work in the European Union, International Labor Office, Geneva, ILO, 2013. Working document number 29] (available at: http://www.oit.org/wcmsp5/groups/public/---ed_dialogue/---lab_admin/documents/publication/wcms_622832.pdf)
17. Стојшић, Љ., (2013). Инспекцијски надзор у области рада, докторска дисертација, Правни факултет Универзитета у Новом Саду [*in English*: Stojšić, Lj., (2013). Inspection in the field of work, Doctoral dissertation, Faculty of law, University of Novi Sad]
18. Anketa o radnoj snazi, III kvartal 2022. godine, Republički zavod za statistiku, [*in English*: Labor Force Survey, 3rd quarter of 2022, Statistical Office of the Republic of Serbia] (available at: https://publikacije.stat.gov.rs/G2022/Pdf/G20221323.pdf)

PAPER TITLE – USE CAPITAL LETTERS, CENTER, BOLD, TIMES NEW ROMAN, SIZE 12

First Author Name (10pt italic, center align)[1], First Co-Author Name (10pt italic, center align)[2], Second Co-Author Name (10pt italic, center align)[3]

**Corresponding author E-mail: (10pt italic, center align)*

A R T I C L E I N F O

Original/Review Article

Received: *xx May 2018*

Accepted: *xx September 2018*

doi:xxx

UDC xxx

Keywords:

should include 4-6 key words that summarize the contents of the paper /Times New Roman, Italic, 10/

JEL:(www.aeaweb.org/jel/jel_class_system.php) */Times New Roman, Italic, 10/*

A B S T R A C T

The abstract should contain a maximum of 150 words. The abstracts should avoid any abbreviations and mathematical formulas.
The abstract is a summarization of the full report, written in one paragraph, and should include next elements:

1. Purpose
2. Methodology
3. Results
4. Conclusions
5. Recommendations
6. Additional data

/Times New Roman, 10/

Introduction

Page setup: Paper size: width 170 mm x height 240 mm; Margins: top/bottom 20 mm, left/right 18 mm; Layout: header 1,25cm, footer 1,25cm; Orientation: Portrait.

Articles should be written only in English. It is advisable to write the article in the third-person singular or plural with the use of active form. Before paper submission, please check grammatical and spelling mistakes by the spellchecker for the English language.

Paper volume up to 30.000 characters (without spaces) or 15 full pages including the text, figures, tables, references list and appendices. Articles should not be shorter than 10 pages. Depending on papers' quality, Editorial Board could also accept longer articles. Article has to be prepared electronically (on computer), in program MS Word 2003 or some later version of this program.

1 Name, academic position,institution, address, phone number, e-mail, ORCID ID (https://orcid.org/)

2 Name, academic position,institution, address, phone number, e-mail, ORCID ID (https://orcid.org/)

3 Name, academic position,institution, address, phone number, e-mail, ORCID ID (https://orcid.org/)

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.

The purpose of the Introduction should be to supply sufficient background information to allow the reader to understand and evaluate the results of the present study without needing to refer to previous publications on the topic. Much of the Introduction should be written in the present tense. /Times New Roman, 11/

Please define abbreviations and acronyms during their first occurrence within the text, even in case that they were previously defined in article summary. Do not use abbreviations in article title, unless they can not be avoided.

Sub-headings should be written by font **Times New Roman**, **font size 11**, **bold**, **centred**, only first letter capital, interspace between sub-heading and paragraph above 6 pt (**before 6 pt**), and interspace between sub-heading and paragraph below 6 pt (**after 6 pt**). Please use the writing style presented in this template.

Materials and methods

Materials and methods are the second section of an IMRAD paper. Its purpose is to describe the experiment in such retail that a competent colleague could repeat the experiment and obtain the some or equivalent results. Provide sufficient detail to allow the work to be reproduced. Methods already published should be indicated by a reference: only relevant modifications should be described.

For equations and formulas use the Microsoft Equation Editor or addition for equations writing MathType (www.mathtype.com). Use of built-in equation editor within the program Word 2007 is not recommended. Please check if all symbols within the equations/formulas are defined (forthwith after equation/formula). The equations are written using Microsoft Word (MathType); they are consecutively numbered and centered.

Results

Results are the third section of an IMRAD paper. Its purpose is to present the new information gained in the study being reported. It should be clear and concise. The Results are core of the paper. You shouldn`t start the Results section by describing methods that you inadvertently omitted from the Materials and Methods section. The Results must be writing in past tense.

Discussions

The final section of an IMRAD paper. Its purpose is to fit the results from the current study into the preexisting fabric of knowledge. The important points will be expressed as conclusions. This should explore the significance of the results of the work, not repeat them. A combined *Results and Discussion* section is often appropriate. Avoid extensive citations and discussion of published literature.

Many papers are rejected by journal editors because of a fault Discussion.

Conclusions

The main conclusions of the study may be presented in a short Conclusions section, which may stand alone or form a subsection of a *Discussion* or *Results and Discussion* section. Conclusions should provide a summary of important findings and their implicants to the area of research that is the forms of the article.

Acknowledgements

Collate acknowledgements in a separate section at the end of the article before the references and do not, therefore, include them on the title page, as a footnote to the title or otherwise. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proof reading the article, etc.). They should be brief.

Conflict of interests

The authors declare no conflict of interest.

References

All manuscripts should be formatted using the American Psychological Association (**APA**) citation style. For additional examples, consult the most recent edition of the Publication Manual of the American Psychological Association.

Reference (author(s) of quotes) has to be entered directly in the text of article in next form (Petrović, 2012; or Petrović, Marković, 2012; or Mirković et al., 2012). Please do not write them as indexes in square brackets [3] or in footnote. Try to use a footnote only in the case of closer explanation of certain terms, or clarification of real and hypothetic situations. ***Do not numerate the pages.***

Reference list should only include works that have been published or accepted for publication. Unpublished works should be only mentioned in the text. Reference list should be with the bibliographic details of the cited books, book chapters, or journal articles.

References in not-English languages should be translated in English, and the English language has to be mentioned in brackets, for example: Максимовић, Г., Секулић, Д., Петровић, А., & Драгичевић, Д. (2017), Савремени трендови и нове стратегије конкурентности у хотелијерству, *Менаџмент у хотелијерству и туризму,* 5(2), 27-35. [in English: Maksimović, G., Sekulić, D., Petrović, A., & Dragičević, D. (2017). Contemporary trends and new competitiveness strategies in hotel industry. Hotel and Tourism Management, 5(2), 27-35.].

Literature units have to be written in font TNR, font size 11, alignment Justified, with mutual interspace of 3 pt - before/after. In all literature units only surnames are written as a whole, while all authors' names has to be shorten on to initial (initials have to

be set after surnames). Please, write surnames of all authors (do not use the style Petrović et al.). Do not combine literature units (under each ordinal number can be only one literature unit) and always write complete titles of used literature units. If used/cited literature was taken over from the internet publication, after adequate writing of literature unit, in brackets has to be note complete link from which material was taken over (available at: www.fao.org).

Citation of Books

Author's surname Initial(s) of the given name(s). (Year of Publication) *Title of Book*, Volume number (if relevant), edition (if relevant). Publisher, Place of Publication

Citation of Articles

Author's surname Initial(s) of the given name(s). (Year of publication) Title of article. *Journal Volume number* (and issue number if issues within a volume number are not consecutively paginated): Number of first and last page of article, DOI

If the cited paper is given a DOI number, it should also be included.

Citation of Websites

Author's surname Initial(s) of the given name(s). (if known) title, type of document (if relevant), date of issue (if available), web address and date of access, if the document or the website may be subject to change.

Citing a journal article found online

Author, A. (Publication Year). Article title. Periodical Title, Volume(Issue), pp.-pp. DOI:XX.XXXXX or Retrieved from journal URL

Example:

1. Cvijanović, D., Trandafilović, S., & Imamović, N. (2013). Marketing concept in terms of agricultural enterprises development in transitional countries. *Economics of Agriculture, 60*(1), 113-122.
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)

TABLES AND FIGURES

All tables are to be numbered using Arabic numerals.

Tables have to be created within the text of article, not taken in the form of images from other documents. Tables should be numerated according to order of their appearance. Titles of the tables have to be given immediately above the table to which they relate. Please use following style during their formatting. Title of the table should be set with the interspace 6 pt - before and 3pt - after, in font TNR, font **size 10**, alignment **Centered**. Text within the table should be written in the font TNR, font size 9. Bold the text in the heading. Start with next paragraph at the interspace of 6 pt from the table source or note (after). During the article writing please mark in the main text all calls to a certain table (*Table 5*.). Try to fit all tables in article within the specified format of the page (Table properties – preferred width – max 97% - alignment: center). Complete text within the table cells has to be entered in next form (paragraph - spacing: before/ after 0 pt, line spacing: single). In case when table breaks on next page, broken part of the table on next page has to be accompanied by a table header.

Identify any previously published material by giving the original source in the form of a reference at the end of the table caption.

Footnotes to tables should be indicated by superscript lower-case letters (or asterisks for significance values and other statistical data) and included beneath the table body.

For the best quality final product, it is highly recommended that you submit all of your artwork – photographs, line drawings, etc. – in an electronic format.

Example:

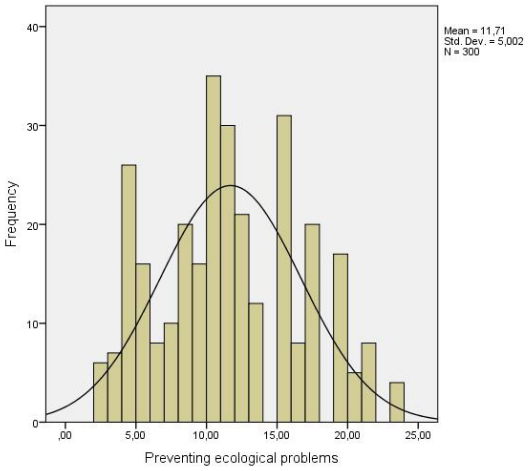
Table 1. The distribution cost of packaged goods from Subotica to retail-store objects

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

All illustrations whether diagrams, photographs or charts are referred to as Figures. The name and number of figures should be centered on the line above a figure.

Figure 1. Agriculture, value added (% of GDP)



Source: Authors' calculations

Technical preparation, prepress and printing:
DIS PUBLIC D.O.O., Braće Jerković 111-25, Belgrade, phone/fax: 011/39-79-789

Number of copies:
300 copies

The Balkan Scientific Association of Agrarian Economists, Belgrade, Serbia, Institute of Agricultural Economics, Belgrade, Serbia and Academy of Economic Studies, Bucharest, Romania is pleased to announce that journal **ECONOMICS OF AGRICULTURE** has been accepted for indexing in the ***Emerging Sources Citation Index (ESCI),*** a new edition of Web of Science.

Content in ESCI is under consideration by Clarivate Analytics, the owner of Web of Science, for additional indexing on the platform, including for the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index.

The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of **ECONOMICS OF AGRICULTURE** in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential **economics of agriculture** content to our community.

You may find necessary information on the following link:
http://mjl.clarivate.com/cgi-bin/jrnlst/jlresults.cgi?PC=MASTER&ISSN=0352-3462

Published quarterly

Journal is registered in major scientific databases:

- Web of Science (Clarivate Analytics) – Emerging Sources Citation Index (ESCI)
- EBSCO
- DOAJ
- ERIH PLUS
- AgEcon Search
- Social Science Research Network (SSRN)
- ProQuest
- Library of Congress E-Resources Online Catalog
- Ingenta Connect
- Ulrich's Periodicals Directory
- CABI
- J-Gate
- The World Wide Web Virtual Library for European Integration
- SCIndeks
- The digital repository of the National Library of Serbia
- doiSerbia
- EconLit
- WorldCat
- Mendeley
- CyberLeninka
- Google Scholar
- CNKI (China National Knowledge Infrastructure)
- ERIH PLUS by Dimensions
- Agora
- Publons
- Internet Archive

EconLit Journal is indexed in major scientific databases:

- Index Copernicus Journals Master List (ICV2013: 5,22).

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

33:63(497.11)

ЕКОНОМИКА пољопривреде = Economics of Agriculture / editor-in-chief Drago Cvijanović. - Год. 26, бр. 5 (1979)- . - Београд : Научно друштво аграрних економиста Балкана : Институт за економику пољопривреде ; Букурешт : Академија економских наука, 1979- (Belgrade : Dis Public). - 24 cm

Тромесечно. - Је наставак: Економика производње хране = ISSN 0352-3454. - Друго издање на другом медијуму: Економика пољопривреде (Online) = ISSN 2334-8453
ISSN 0352-3462 = Економика пољопривреде (1979)
COBISS.SR-ID 27671

The Ministry of Education, Science and Technological Development of the Republic of Serbia provides financial support for publishing of the quarterly journal
ECONOMICS OF AGRICULTURE