UDC 338.43:63

ISSN 0352-3462

ЕКОНОМИКА ПОЉОПРИВРЕДЕ
ECONOMICS OF AGRICULTURE

Vol. LXXII, №1 (1-396), 2025

BELGRADE

UDC 338.43:63

ISSN 0352-3462

ЕКОНОМИКА ПОЉОПРИВРЕДЕ
ECONOMICS OF AGRICULTURE

Journal is indexed and abstracted in Emerging Sources Citation Index.

72.

Према категоризацији научних часописа, у Листи домаћих часописа за 2024. годину, Табела 25. КАТЕГОРИЗАЦИЈА ДОМАЋИХ НАУЧНИХ ЧАСОПИСА ЗА ЕКОНОМИЈУ И ОРГАНИЗАЦИОНЕ НАУКЕ,
“Економика пољопривреде”
је сврстана у категорију **М 23 - Међународни часопис”**
https://nitra.gov.rs/cir/nauka/kategorizacija-naucnih-casopisa

Београд, јануар - март 2025. године
Belgrade, January - March, 2025

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)

Национални институт за економска истраживања „Costin C. Kiritescu“ – Румунска академија, Букурешт (Румунија)

National Institute for Economic Research “Costin C. Kiritescu” - Romanian Academy, Bucharest (Romania)

EDITOR-IN-CHIEF

Prof. Drago Cvijanovic, Ph.D., University of Kragujevac,
Faculty of Hotel Management and Tourism, Vrnjci Spa, Serbia

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

1. Dragana Petrović, Milan Novović, Milan Šoškić:
COMPARATIVE ANALYSIS OF MILLING-BAKERY AND CONFECTIONERY INDUSTRY IN SERBIA BASED ON BENFORD'S LAW 13

2. Milan Mihajlović, Toma Dašić, Svetlana Mihić:
ECONOMIC ANALYSIS OF THE POSSIBILITIES FOR BUSINESS PROCESSES IMPROVEMENT IN SERBIAN DAIRY INDUSTRY 33

3. Katica Radosavljević, Vesna Paraušić, Branko Mihailović, Danijela Pantović:
ASSESSING THE SATISFACTION LEVEL OF RURAL TOURIST HOUSEHOLDS (RTH) IN SERBIA WITH THE ECONOMIC SUSTAINABILITY DIMENSION 45

4. Nedeljko Prdić, Tamara Gajić, Saša Stepanov:
WHOLESALE MARKETS AS SUPPLY CHANNELS FOR GREEN MARKETS AND THEIR IMPACT ON RURAL DEVELOPMENT IN SERBIA 63

5. Milica Grujić:
CORPORATE BRAND IN AGRICULTURE WITH RESPECT FOR THE LIMITING FACTS OF MARKETING APPLICATION IN THE EXAMPLE OF THE REPUBLIC OF SERBIA 89

6. Vesna Milanović, Vesna Miletić, Aleksandra Jagodić Rusić, Jasmina Poštin:
THE EFFECTS OF INTERNAL GREEN MARKETING ON JOB SATISFACTION AND FINANCIAL OUTCOMES – THE CASE OF THE SERBIAN AGRIBUSINESS SECTOR. . . 107

7. Lara Lebedinski, Mihajlo Đukić, Dejana Pavlović:
AN ASSESSMENT OF THE SOCIO-ECONOMIC IMPACT OF WATER ACCESS FOR ROMA AND OTHER MARGINALIZED GROUPS IN RURAL SERBIA 123

8. Elena Hoskova, Iveta Zentkova:
DETERMINANTS OF DEMAND FOR FRESH VEGETABLES IN THE SLOVAK REPUBLIC 139

9. Dejan Brcanov, Stojanka Dakić, Danilo Đokić, Nebojša Gvozdenović, Stanislav Zekić:
OPTIMIZATION OF TRANSPORT ACTIVITIES IN THE SUGAR BEET HARVESTING CAMPAIGN 155

10. Jelena Premović, Marko Pavlović, Marija Perić:
THE INFLUENCE OF SOCIO-DEMOGRAPHIC VARIABLES ON THE STATE OF ENVIRONMENTAL AWARENESS OF THE RURAL AREAS POPULATION - EXAMPLE OF SERBIA . . 171

11. Asmaeil Ali Mohammed Khmaaj, Bojana Ostojić, Biljana Ilić, Milena Cvjetković, Jelena Ružić:
ORGANIZATION OF GREEN PROJECTS FOR THE PURPOSE OF PROMOTION AND SATISFACTION OF USERS IN RURAL REGIONS IN SERBIA. 189

12. Reka Korhecz, Marko Vladisavljevič, Otilija Sedlak, Aleksandra Marcikić Horvat, Jelica Eremić Đodić:
DEMOGRAPHIC ANALYSIS OF THE AGRICULTURAL POPULATION OF SERBIA. 205

13. Žarko Rađenović, Ivana Janjić, Miljana Talić, Milica Đokić, Tamara Rađenović, Tatjana Boshkov, Bojan Krstić:
DIGITAL MAPPING OF BUSINESS PERFORMANCE INDICATORS OF AGRICULTURAL HOLDINGS IN SERBIA. . 225

14. Dragana Vuković, Ana Dukić, Ana Urošević, Božo Ilić:
THE IMPACT OF PRODUCT AND PROCESS INNOVATION AND TECHNOLOGICAL DIMENSIONS ON THE SUSTAINABLE COMPETITIVE ADVANTAGE OF MANUFACTURING COMPANIES. 241

15. Miloš Dimitrijević, Vesna Mrdalj, Miljan Leković:
COMPETITIVENESS OF THE AGRICULTURAL SECTOR OF SOUTHEAST EUROPE: THE WESTERN BALKANS VS. EUROPEAN UNION **255**

16. Zorica Mladenović, Emilija Milošević:
THE IMPACT OF MACROECONOMIC UNCERTAINTY AND OIL PRICES ON FOOD PRICES: EMPIRICAL EVIDENCE FROM SERBIA **271**

17. Slobodan Glišić, Predrag Stamenković:
PERCEPTION OF SMALL AND MEDIUM-SIZED HOTEL MANAGERS ON THE ECONOMIC FEASIBILITY OF PROCURING LOCAL AGRICULTURAL PRODUCTS **289**

18. Olja Arsenijević, Maja Dimić:
ECONOMIC EMPOWERMENT OF WOMEN IN RURAL AREAS **315**

19. Bojana Novićević Čečević, Srboljub Nikolič, Snežana Jovanović:
PROFITABILITY DETERMINANTS OF SERBIAN AGRICULTURAL COMPANIES **329**

20. Zlatica Mamlić Vojin Đukić, Petar Čanak, Ana Uhlarik, Sanja Vasiljević, Marija Bajagić, Jegor Mladenović:
HISTORICAL DEVELOPMENT OF SOYBEAN PRODUCTION DEPENDING ON THE AGROECOLOGICAL CONDITIONS OF SERBIA **345**

21. Martina Arsić, Aleksandra Vujko, Dragan Nedeljković:
THE SYNERGY BETWEEN GASTRONOMY AND ACTIVE TOURISM AS INDICATORS OF SUSTAINABLE RURAL WELLNESS AND SPA DESTINATION DEVELOPMENT - SOKOBANJA CASE STUDY **357**

22. Dušan Aničić, Olgica Nestorović, Jugoslav Aničić, Zoran Jovanović:
TRENDS AND PERSPECTIVES OF AGRICULTURAL DEVELOPMENT IN SERBIA **375**

COMPARATIVE ANALYSIS OF MILLING-BAKERY AND CONFECTIONERY INDUSTRY IN SERBIA BASED ON BENFORD'S LAW

Dragana Petrović[1], Milan Novović[2], Milan Šoškić[3]

**Corresponding author E-mail: dragana.petrovic@mef.edu.rs*

ARTICLE INFO

Original Article

Received: *27 November 2024*

Accepted: *12 December 2024*

doi:10.59267/ekoPolj250113P

UDC 664.6/.7+664.144/.149(497.11)

Keywords:

Benford's law, mill-bakery industry, confectionery industry, Statement of cash flows

***JEL**:G33, M41,M42*

ABSTRACT

This study aims to apply Benford's Law when detecting fraud and errors in financial statements. The research includes the practical use of this law on examples of large and medium-sized enterprises in the milling, baking and confectionery industry in Serbia. Based on the conducted data analysis and the obtained results, the authors ranked the companies, after which, through a comparative analysis between these two branches, they showed which data in the Cash Flow Report have greater deviations from Benford's analysis. The obtained data are determined by means of a statistical investigation of the probability distribution of a random variable, where it should be borne in mind that data with lower figures are expected to be more numerous than data with higher figures. The results of the analysis tabularly and graphically present an overview of the movement of cash flows of companies in the milling, baking and confectionery industry.

Introduction

Benford's law represents the law of the leading digit, that is, the phenomenon of anomalous numbers, the main purpose of which is to determine anomalies in numbers in financial statements. Through the presented research, the authors will present the phenomenon of Benford's law and, based on that, the determination of the validity of financial statements. This law is based on the probability that the frequency of occurrence of data starting with the digit 1 makes up a third of the data, while with the increase in

1 Dragana Petrović, Ph.D., Assistant Professor, Faculty of Applied Management, Economics and Finance (MEF), Jevrejska 24/1, 11000 Belgrade, Serbia, Phone: +381 62 292 702, E-mail: dragana.petrovic@mef.edu.rs, ORCID ID (https://orcid.org/0000-0001-5511-6412)

2 Milan Novović, Ph.D., Professor professional studies, Higher Business School of Proffesional Studies, Gradski park 2, 11080 Belgrade, Serbia, Phone: +381 64 301 85 35, E-mail: novovic.milan@gmail.com, ORCID ID (https://orcid.org/0000-0002-6944-7973)

3 Milan Šoškić, Mr.Sc., Lecturer professional studies, Higher Business School of Proffesional Studies, Gradski park 2, 11080 Belgrade, Serbia, Phone: +381 64 174 44 43, E-mail: soskic.milan.vps@gmail.com, ORCID ID (https://orcid.org/0000-0001-5018-2162)

the value of digits from 1 to 9, that probability gradually decreases (Cvetković, 2023). The first written paper on Benford's law was presented by the American astronomer and mathematician Dr. Simon Newcomb (Tödter, 2009). He noticed that the first pages of the logarithmic tables with lower numbers were significantly worn compared to the back pages with higher numbers, because his colleagues most often used the tables of lower numbers to look up logarithms. Based on this, he concluded that most natural data sets meet the established regularity (Durtschi et al., 2004). He described his research in a paper published in The American Journal of Mathematics as early as 1881. Newcomb logically concluded that raw data with low initial numbers are more numerous than those with high ones (Jukić & Muhurdarević, 2003). However, the article he wrote went unnoticed because he did not support his theoretical research with any arguments. About fifty years later, in 1938, an American physicist named Frank Benford checked this regularity and obtained the same results indicating that data beginning with the digit 1 has a probability of appearing in 30% of a set of numbers, and that the frequency of data decreases as the digits increase (e.g. only 4% of the data starts with the number 9). This law can be applied in all areas of life (length of rivers, population, height of mountains, number of inhabitants or astronomical data where the figures of the data approximate a logarithmic distribution), and it is especially applied by forensic accountants and auditors when detecting falsification of data in financial reports (Watrin et al., 2008). They collect the data for processing in order to determine the deviations of certain parts of the financial statements from Benford's analysis and the reasons for the disagreement, in order to finally form their opinion (Milojević et al., 2018). Before conducting a Benford analysis, forensic accountants and auditors conduct an examination of the situation and record every detail, thus securing a database and only after completing these actions proceed with data analysis (Hoopwood et al., 2014)

The problem of this kind of research in numerous works are criminal acts and manipulations in financial reports in Serbia. The emphasis is on reliable financial reporting, where the responsibility for preventing financial manipulations and errors lies mostly with the management of the company (Deckert et al., 2011; Halilčević, 2019). Specifically, the authors will analyze the financial statements, i.e. Cash flow reports using Benford's law in the Serbian food industry. In doing so, it will include large and medium-sized legal entities that operate within two branches of the food industry, namely the mill-bakery industry and the confectionery industry. For this analysis, the Report on the movement of cash flows was used for a period of time covering three years, namely 2022, 2021 and 2020. This report is used for the reason that cash flows represent the "blood stream" of a business as inflows and outflows are constantly circulating. Based on these flows, it is determined how liquid and solvent the company is, which is important for business decision-making. Data on companies were taken from the Agency for Business Registers.

The goal of this research is to determine abnormalities in accounting data, on the basis of which manipulations in the financial statements of economic entities are detected (Singleton et al., 2006; Kruger & Yadavalli, 2017). The priority of financial reporting is

the provision of quality financial information on the movement of cash flows in order to satisfy the information needs of users of financial reports (Petrović et al., 2023). However, it should be borne in mind that if there is a deviation in the figures from Benford's law, it does not necessarily mean that the data has been manipulated, but it can also be a random error that forensic accountants should keep in mind. Through research in the paper, the authors will present the results for each individual company that operates in one of these two segments of the food industry, after which they will compare the results with the set values in Benford's Law. Consequently, their deviations will be determined and a comparative analysis will be carried out to determine in which companies of these two branches of the food industry there are the greatest abnormalities in the Cash Flow Statements.

Literature review

There is a large number of relevant scientific sources that deal with the phenomenon of the leading figure, as well as its application to determine fraudulent actions in financial statements. At issue is the law that data starting with low starting numbers are more numerous than data with high ones, which is contrary to normal human thinking. The numbers 1 through 9 should have an equal chance of coming first in the data. However, based on the above, in the opinion of researcher Benford, the figures in the data do not have an equal chance of being in the first place, but follow an uneven distribution. Benford called this phenomenon the Law of the First Digit and published it in 1938 in his paper entitled "The Law of Numbers with Anomaly" in an American scientific journal. It is a logarithmic distribution. He proved his experiment based on a calculation he performed manually on 20,229 analyzed natural sets (Benford, 1938).

This described phenomenon is also addressed in other research studies. One of them is a study related to the application of Benford's law in detecting anomalies in the financial statements of large companies in Serbia (Milojević et al., 2014). In the aforementioned research, an analysis of certain accounting positions for large companies in Serbia was carried out. Namely, fixed assets are included in the balance sheet and net result in the income statement. The obtained results showed that the fixed assets were realistically presented, but that there were significant deviations in the net result compared to the realized net result. These results indicate that some companies show a lower net result compared to the realized one in order to avoid paying profit tax, while other companies show a higher result than the realized one in order to have a better image in the public. The following research applies Benford's law to accounting data related to health institution costs (Cvetković, 2023). In this paper, the cost structure for each department and each activity is analyzed. Based on the data analysis performed using the Microsoft Excel package, the auditors determined that fraudulent actions are possible in the provision of hospital services, pathology and pharmacy operations. In addition, they found that the data related to the frequency of occurrence of the first and second digits of Benford's law in the resuscitation and emergency departments did not agree. Both studies conclude that this law represents a warning signal and a red flag that there

may be fraudulent activities in the analyzed data, but the aforementioned law does not provide absolute proof in detecting fraud.

In a study related to the effective use of Benford's law in detecting fraud in accounting data (Durtschi et al., 2004) it was explained that the phenomenon of Benford's law should help auditors and forensic accountants to use digital analysis to determine which figures deviate from the Benford distribution. The authors indicated that auditors should use this analysis with some caution, as it can only identify sets of numbers that deviate. This means that a deeper analysis cannot be performed, nor can the causes of these deviations be determined. Therefore, they suggest that auditors and forensic accountants when performing analytical procedures should apply different types of digital analysis when determining the validity of observed data.

The next interesting research is a study in which the question was raised whether the macroeconomic data of the member states of the European Union truthfully depict the state of a country (Rauch et al., 2011). These researchers assumed that if Benford's law can be applied to determine the veracity of a company's financial statements, then it can also be used to determine the validity of government financial reporting. Accordingly, they conducted a survey of the quality of macroeconomic indicators for those countries that sent reports on the realized deficit in the year. Their results showed that the data sent by Greece had the biggest deviations compared to other members, which is why they questioned the validity of this data.

Another research focusing on Benford's analysis was done by a Harvard mathematics professor and grandson of Frank Benford named Steven J. Miller (Miller, 2015). In his book written in 2015, he emphasized that the descendants of Simon Newcomb have every right to complain about the historical injustice towards their ancestor, because he was the first to notice this legality, but failed to prove it empirically. In the same book, he showed that Benford's law can be applied in various disciplines such as accounting, economics, medicine, computer science or psychology.

The phenomenon of the first digit is based on the attitude that half of the numbers from the observed population start with the digits 1 and 2, which means that each digit individually does not have an equal chance of appearing (Nigrini, 2012). Data are tabulated next to each digit they start with, such as population by city or portfolio of securities. It's an uneven game because the lower digits have priority to be in first place. This phenomenon was described by Nigrini, who is a pioneer in the application of Benford's law in the world of forensic accounting and auditing, as a tool for detecting financial manipulations and errors.

Materials and methods

Benford's law is a numerological phenomenon that determines the expected probabilities, more precisely the frequency of occurrence of digits in the first position. The essence of this analysis is the detection of abnormalities in the data based on the observed frequencies of digits in a certain set (Diekmann & Ben, 2010). With the application

of this law, testing is carried out with coverage of 100% of the observed population (kilograms, euros, volume of trade, costs, etc.). This is especially important for auditors and forensic accountants when determining whether there has been manipulation in the transactions of the observed population (Mrvaljević et al., 2022).

Calculation of the frequency of occurrence of the first significant digit will be presented using the logarithmic formula (Miller, 2015). This means that a set of certain digits satisfies Benford's law in the event that the calculation of the probability of the frequency of the first digit equals (Kaisher, 2019):

$$P(d) = \text{Log}\ (1+1/d)$$

where the number is: d number 1,2,3…, 9 and

P - probability of occurrence.

Benford presented the expected frequencies of occurrence of digits in the first position in the following table, guided by the fact that in nature there are many more small sizes compared to large ones (Kossovsky, 2014):

Table 1. The probability of the digit appearing in the first position according to Benford's law

Digit	Expected probability of the digit appearing in the first position	Expected probability of the digit appearing in the second position	Expected probability of the digit appearing in the third position
0		0,1197	0,1018
1	0,30103	0,1139	0,1014
2	0,17609	0,1088	0,1010
3	0,12494	0,1043	0,1006
4	0,09691	0,1003	0,1002
5	0,07918	0,0967	0,9980
6	0,06695	0,0934	0,9940
7	0,05799	0,0904	0,9900
8	0,05115	0,0876	0,9860
9	0,04576	0,0850	0,983

Source: Nigrini, 2012.

Based on the presented table 1, one can see the expected probabilities of digits appearing in the first, second and third positions of a certain set. It should be emphasized that in the case when the value of the digit in the data sets increases, the probability of the first digit appearing in the Benford analysis decreases (Amiram et al., 2015). This is contrary to human logic, according to which each of the given digits should have the same probability of appearing first in a given set. However, according to Benford, the first digits have a logarithmic distribution where the highest frequency of occurrence in column 1 is digit 1 with 30.1%, and the frequency of occurrence of digit 2 is 17.1%, which means that the first digits 1 and 2 account for 47.7% set of observed data (Miller et al., 2010). The digits with the lowest frequency of occurrence are 8 with 5.15% and 9 with 4.57%, which makes up only 9.72% of the observed data. As shown, Benford's

law represents the expected frequency of occurrence of digits in tabular data, keeping in mind that half of the digits of one set in column 1 will start with the numbers 1 and 2 (Nigrini, 2012).

The expected frequency formula for the first digit of a set reads (Durtschi et al., 2004):

$$\text{Probability } D_1 = d_1 = \log (1 + 1 / d_1)$$

where is $d_1 = (1, 2, 3\ldots, 9)$

The formula for the expected frequency for the second digit of a set is:

$$\text{Probability } D_2 = d_2 = \sum_{d1=1}^{9} \log (1 + 1 / d_1 d_2) \sum_{d1=1}^{9} \log (1 + 1 / d_1 d_2)$$

where is $d_2 = (1, 2, 3\ldots, 9)$

The formula for the expected frequency for two combinations of probabilities is:

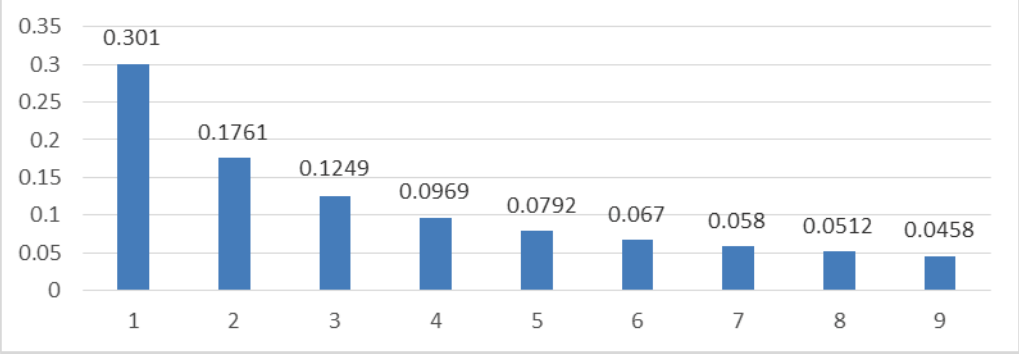
$$\text{Probability } D_1 D_2 = d_1 d_2 = \log (1 + (1 / d_1 d_{2)})$$

$$\text{Probability } (D_2 = d_2 \text{ I } D_1 = d_1) = \log (1 + (1 / d_1 d_2)) / \log (1 + 1 / d_1)$$

where D_1 represents the first digit, and D_2 the second digit, etc.

The frequency of occurrence of the first digits can be shown graphically where it is best seen that the numbers of the data set are geometrically distributed. The focus is on the exponential decrease in the frequency of occurrence of members in a one-dimensional sequence (Beger & Hill, 2011).

Figure 1. Benford's distribution of occurrences of first digits



Source: Walthoe, 2011

This methodology will be applied when analyzing the data in the Cash Flow Report for large and medium-sized enterprises of the milling, baking and confectionery industry operating on the territory of Serbia in a period of three years. A comparative analysis will provide data on whether the Cash Flow Statements realistically show the inflows and outflows of these companies or whether there are certain abnormalities. When it comes to the milling and baking industry, the most important companies will be

included such as: Pekara Pons doo, Bečejska pekara ad, Klas group doo, Don Don doo and Moka doo. In addition, cash flows of the following companies will be analyzed in the confectionery industry: Atlantic Štark doo, Jaffa doo, Nelt Co doo and Bambi ad. The authors will first calculate the frequency of the figures appearing in the Cash Flow Report of the listed companies of these two branches of the food industry and, based on that, perform a comparison and comparative analysis of these companies. The results will be tabulated and graphically presented in order to see which companies have significant deviations. At the end, these two activities will be compared in order to obtain a result in which it can be seen whether the movement of cash flows is more realistically shown in the mill-bakery or confectionery industry.

Results and disussions

On the official website of the Agency for Economic Registers (APR), data from the Cash Flow Report of the mentioned companies for the period of three years (2022, 2021 and 2020) have been downloaded. The data were then sorted individually in Excel, backwards in time, for each company, and the results of Benford's analysis were calculated on the basis of pre-given formulas.

Important for this analysis, the following columns are shown in the tables: First, Count, Actual, Benford Law, Difference, AbsDiff and Z-statistics. The First column lists the digits from 1 to 9, to calculate how many times they occur first in the sorted data for all companies, individually, by the LEFT function. This is shown by the Count column, where, based on the CountIF function, it was calculated exactly how many digits there are from 1 to 9 in the total number of digits for each company. The Actual column shows the percentage of the actual number of occurrences of each digit in the total amount (individually by company). This, then, is the actual number of occurrences of each digit from 1 to 9 as the first number in the cash flow statements for the listed companies, and this constitutes the null hypothesis in our case. The next column is the Benford Law, which is calculated by the formula =ROUND(LOG10(1+1/FIRST),5). After that, the actual percentage numbers (Actual column) are compared with the expected percentage numbers (Benford Law column) and the deviation is calculated. The actual obtained percentages, most often, to a greater or lesser extent, deviate from the expected percentages according to Benford's law due to random variation. To determine the size of the deviation, a Z-test (Z-stat column) is used, which detects whether the percentage deviation of a certain figure is too high, indicating that the number is subject to manipulation or that there may be an error in the cash flow statements.

Table 2 shows the results of Benford's analysis for large and medium-sized enterprises of the mill-bakery industry. For each company, the numbers with the largest deviation of the actual numbers compared to the expected numbers are shaded.

Table 2. Benford's analysis for cash flow statements of companies in the milling and baking industry

Pekara Pons doo						
First	**Count**	**Actual**	**Benford' Law**	**Difference**	**AbsDiff**	**Z-stat**
1	33	39,76	30,10%	0,097	0,096560	2,3301408
2	12	14,46	17,61%	-0,032	0,031513	4,2733347
3	10	12,05	12,49%	-0,004	0,004457	0,5538322
4	4	4,82	9,69%	-0,049	0,048717	0,5610839
5	9	10,84	7,92%	0,029	0,029252	0,4688756
6	5	6,02	6,69%	-0,007	0,006706	2,1686178
7	1	1,20	5,80%	-0,046	0,045944	1,4496971
8	1	1,20	5,12%	-0,039	0,039104	0,3645336
9	8	9,64	4,58%	0,051	0,050628	0,0785473
Moka doo						
First	**Count**	**Actual**	**Benford' Law**	**Difference**	**AbsDiff**	**Z-stat**
1	26	34,21	30,10%	0,041	0,041075	3,38
2	12	15,79	17,61%	-0,018	0,018197	3,37512
3	11	14,47	12,49%	0,020	0,019798	0,58406
4	9	11,84	9,69%	0,022	0,021511	1,632539
5	1	1,32	7,92%	-0,066	0,066023	1,228571
6	6	7,89	6,69%	0,012	0,012001	0,50847
7	6	7,89	5,80%	0,021	0,020955	0,3309
8	4	5,26	5,12%	0,001	0,001479	0,57978
9	1	1,32	4,58%	-0,033	0,032600	0,57412
Don don doo						
First	**Count**	**Actual**	**Benford' Law**	**Difference**	**AbsDiff**	**Z-stat**
1	39	47,56	30,10%	0,175	0,174580	2,960266
2	10	12,20	17,61%	-0,054	0,054140	2,219145
3	2	2,44	12,49%	-0,101	0,100548	0,033432
4	3	3,66	9,69%	-0,060	0,060325	0,37043
5	7	8,54	7,92%	0,006	0,006185	2,756985
6	5	6,10	6,69%	-0,006	0,005971	1,938389
7	7	8,54	5,80%	0,027	0,027374	0,25167
8	6	7,32	5,12%	0,022	0,022018	0,02835
9	3	3,66	4,58%	-0,009	0,009172	0,53899
Bečejska pekara ad						
First	**Count**	**Actual**	**Benford' Law**	**Difference**	**AbsDiff**	**Z-stat**
1	12	21,43	30,10%	-0,087	0,086744	1,587872
2	10	17,86	17,61%	0,002	0,002480	1,587872
3	5	8,93	12,49%	-0,036	0,035653	2,478113
4	6	10,71	9,69%	0,010	0,010233	2,107379
5	6	10,71	7,92%	0,028	0,027962	0,46447
6	9	16,07	6,69%	0,094	0,093767	0,78243
7	1	1,79	5,80%	-0,040	0,040135	0,75046
8	6	10,71	5,12%	0,056	0,055990	0,100877
9	1	1,79	4,58%	-0,028	0,027900	0,339068
Klas group doo						

First	Count	Actual	Benford' Law	Difference	AbsDiff	Z-stat
1	22	24,44	30,10%	-0,057	0,056586	2,221597
2	8	8,89	17,61%	-0,087	0,087202	1,511278
3	11	12,22	12,49%	-0,003	0,002717	0,13975
4	10	11,11	9,69%	0,014	0,014201	0,64089
5	11	12,22	7,92%	0,043	0,043041	0,43257
6	11	12,22	6,69%	0,055	0,055275	2,189731
7	9	10,00	5,80%	0,042	0,042008	2,053418
8	3	3,33	5,12%	-0,018	0,017819	0,55766
9	5	5,56	4,58%	0,010	0,009798	0,60388

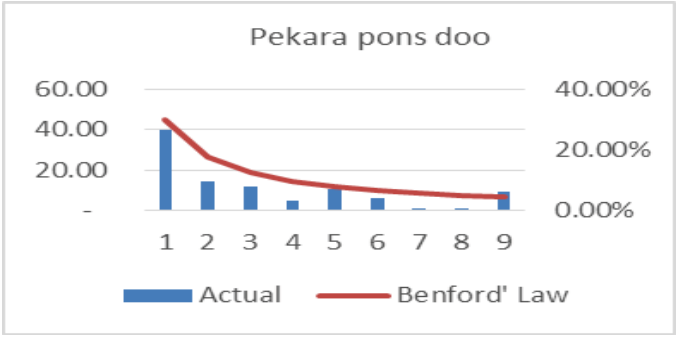
Source: Authors

As can be observed, in all enterprises of the mill-bakery industry, the first digits in real measurement are logarithmically distributed with the highest probability of occurrence of the digit 1 of 30.10%, and with the lowest frequency of occurrence of the digit 9 of 4.58%, which is in accordance to Benford's law (Wang & Ma, 2023). However, the actual number of occurrences of figures deviates from the expected, and that is with several figures, which indicates the desire of the management of the mentioned companies to embellish the financial statements. The analysis is aimed at showing the biggest deviations in each company, i.e. those deviations that are statistically significant. Specifically, the largest deviations in the cash flow statements of Pekara Pons doo refer to numbers 4, 7 and 8, while the company Moka doo has the largest deviation in numbers 5 and 9. Pekara Don don doo records the largest deviations in numbers 2, 3 and 4, and Bečejska pekara in figures 5, 6, 7 and 8. Klas group doo has deviations in figures 2, 5, 6 and 7. This indicates the fact that the positions in the Cash Flow Statements that begin with the mentioned numbers deviate statistically significantly from the predicted distribution. Therefore, forensic accountants and auditors must pay attention to these positions and investigate them. The deviations of the actual number of occurrences in relation to the expected number of occurrences of other digits are not statistically significant, which means that the probability of occurrence of each digit is in accordance with Benford's law.

Taking into account the results in Table 2, it can be seen that the distribution of figures with which companies from the milling and baking industry report cash flows in the corresponding statements does not behave completely in accordance with Benford's distribution. Unrealistic financial statements, especially cash flows, can mislead stakeholders about the company's earning capacity (Belopavlović, 2014). Therefore, a more detailed analysis of those reports is needed.

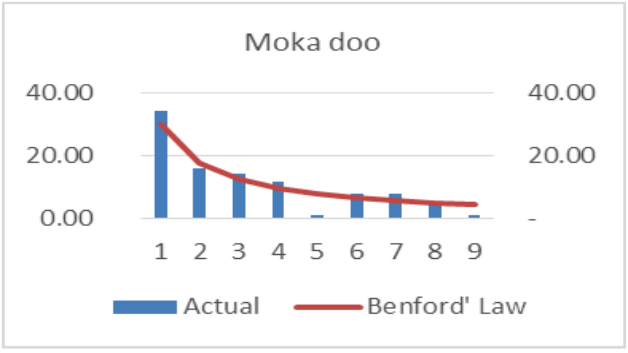
The results of Benford's analysis can be displayed graphically, where data from two columns (Actual and Benford' Law) are compared, i.e. the actual and expected number of occurrences of the first digit in cash flow positions. It also shows exactly where deviations occurred, to a lesser or greater extent (Lagarias & Soundararajan, 2006).

Figure 2. The relationship between the actual number of occurrences of first digits and Benford's law in Cash Flow Statements for Pekara Pons doo



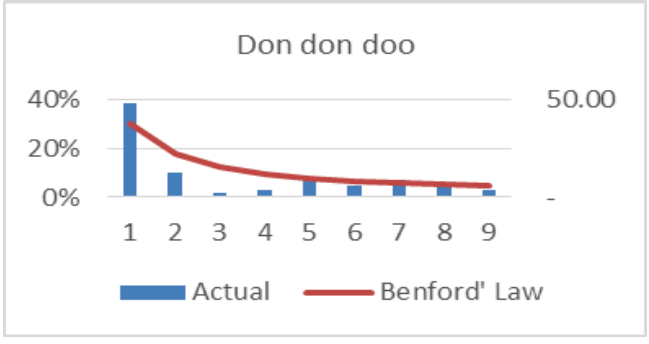
Source: Authors

Figure 3. The relationship between the actual number of occurrences of first digits and Benford's law in Cash Flow Statements for Moka doo



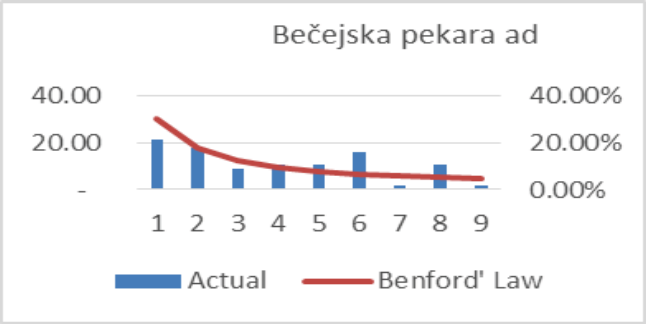
Source: Authors

Figure 4. The relationship between the actual number of occurrences of first digits and Benford's law in Cash Flow Statements for Don don doo



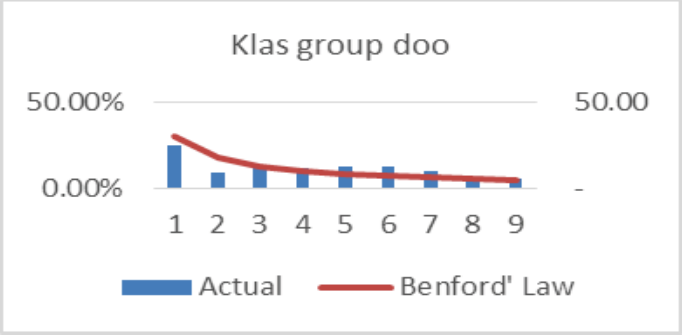
Source: Authors

Figure 5. The relationship between the actual number of occurrences of first digits and Benford's law in Cash Flow Statements for Bečejska pekara ad



Source: Authors

Figure 6. The relationship between the actual number of occurrences of first digits and Benford's law in Cash Flow Statements for Klas group doo



Source: Authors

According to the same procedure, Benford's analysis is performed for large and medium-sized enterprises of the confectionery industry, the results of which are shown in Table 3. For each enterprise, the numbers with the largest deviation from the actual numbers in relation to the expected numbers are shaded.

Table 3. Benford's Analysis for Cash Flow Statements of Confectionery Industry Companies

Bambi ad						
First	**Count**	**Actual**	**Benford' Law**	**Difference**	**AbsDiff**	**Z-stat**
1	32	33,33	30,10%	0,032	0,032303	2,787629
2	20	20,83	17,61%	0,032	0,032242	1,942494
3	8	8,33	12,49%	-0,042	0,041605	0,171814
4	9	9,38	9,69%	-0,003	0,003160	0,66649
5	6	6,25	7,92%	-0,017	0,016681	0,65972
6	4	4,17	6,69%	-0,025	0,025280	2,109889
7	3	3,13	5,80%	-0,027	0,026742	0,940157
8	8	8,33	5,12%	0,032	0,032181	0,09046
9	6	6,25	4,58%	0,017	0,016743	0,3329

Jaffa doo						
First	**Count**	**Actual**	**Benford' Law**	**Difference**	**AbsDiff**	**Z-stat**
1	31	31,63	30,10%	0,015	0,015297	2,763007
2	13	13,27	17,61%	-0,043	0,043438	1,719438
3	7	7,14	12,49%	-0,054	0,053510	0,378376
4	8	8,16	9,69%	-0,015	0,015277	0,60742
5	13	13,27	7,92%	0,053	0,053472	0,54966
6	10	10,20	6,69%	0,035	0,035094	2,440802
7	7	7,14	5,80%	0,013	0,013437	1,508201
8	4	4,08	5,12%	-0,010	0,010336	0,35352
9	5	5,10	4,58%	0,005	0,005263	0,09196
Atlantic Štark doo						
First	**Count**	**Actual**	**Benford' Law**	**Difference**	**AbsDiff**	**Z-stat**
1	31	35,63	30,10%	0,055	0,055292	2,486345
2	8	9,20	17,61%	-0,084	0,084137	2,200947
3	7	8,05	12,49%	-0,044	0,044479	0,424
4	5	5,75	9,69%	-0,039	0,039439	0,60519
5	9	10,34	7,92%	0,024	0,024267	0,50105
6	6	6,90	6,69%	0,002	0,002019	2,317362
7	10	11,49	5,80%	0,057	0,056951	1,438579
8	5	5,75	5,12%	0,006	0,006319	0,2346
9	6	6,90	4,58%	0,023	0,023208	0,2487
Nelt Co doo						
First	**Count**	**Actual**	**Benford' Law**	**Difference**	**AbsDiff**	**Z-stat**
1	47	39,50	30,10%	0,094	0,093928	2,399476
2	23	19,33	17,61%	0,017	0,017186	2,336816
3	13	10,92	12,49%	-0,016	0,015695	0,44406
4	8	6,72	9,69%	-0,030	0,029683	0,49816
5	7	5,88	7,92%	-0,020	0,020358	0,49159
6	4	3,36	6,69%	-0,033	0,033333	2,365959
7	5	4,20	5,80%	-0,016	0,015975	2,124532
8	2	1,68	5,12%	-0,034	0,034346	0,41453
9	10	8,40	4,58%	0,038	0,038276	0,37937

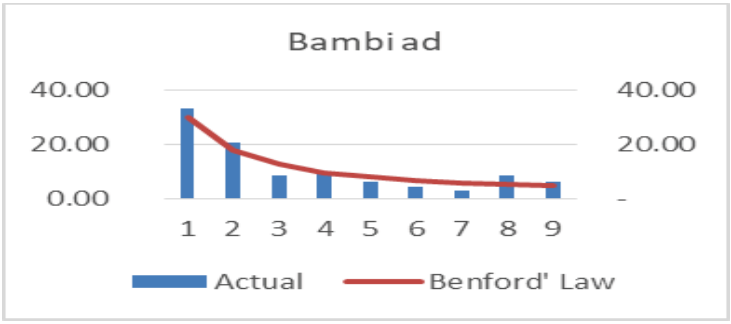
Source: Authors

As shown in the table, the actual number of figures appearing in these companies also deviates from the expected, but to a lesser extent, which indicates the fact that the management in confectionery industry companies presented the figures more realistically in the financial reports. Specifically, at the company Bambi ad, the largest deviations refer to digits 3 and 8. The company Jaffa doo has the largest deviations on digits 3 and 5. Atlantic Štark doo records the largest deviations on digits 2 and 7, while Nelt Co doo has the largest deviations on digits 2 , 3, 4, 5, 6 and 8. Other deviations are not statistically significant.

In these companies, as well as in the mill-bakery industry, regardless of the lower deviations, the arrangement of figures showing the cash flows in the Cash Flow Statements does not fully behave with the Benford distribution. Presenting a distorted picture in financial reports is most often aimed at misleading interested parties, which

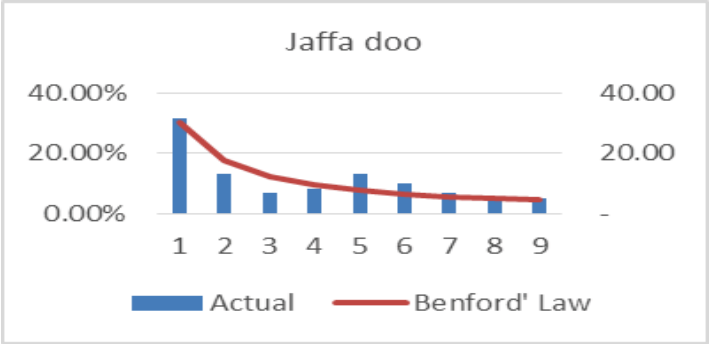
is why their more detailed analysis is needed (Cvetković & Bošković, 2018). The above results of Benford's analysis for companies in the confectionery industry can be presented graphically, from which the actual and expected number of occurrences of the first digit in the cash flow positions can be clearly seen.

Figure 7. The relationship between the actual number of occurrences of the first digits and Benford's law in Cash Flow Statements for Bambi ad



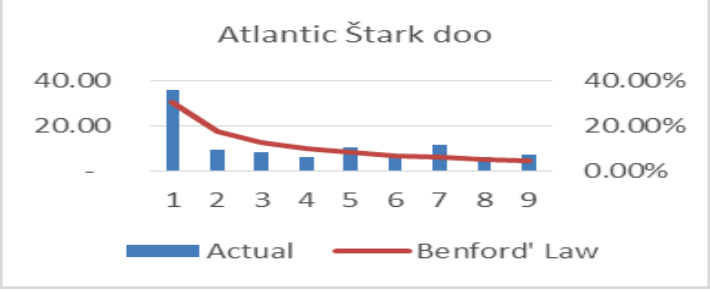
Source: Authors

Figure 8. The relationship between the actual number of occurrences of the first digits and Benford's law in Cash Flow Statements for Jaffa doo



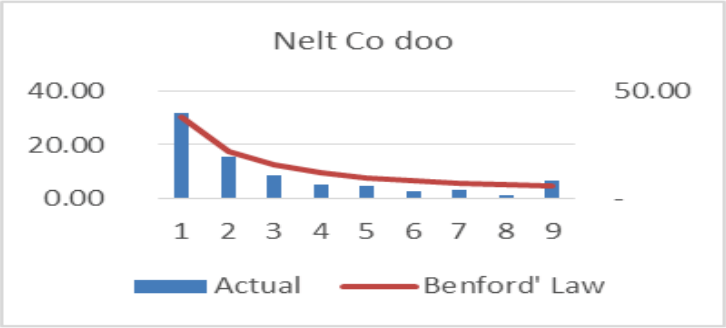
Source: Authors

Figure 9. The relationship between the actual number of occurrences of the first digits and Benford's law in Cash Flow Statements for Atlantic Štark doo



Source: Authors

Figure 10. The relationship between the actual number of occurrences of the first digits and Benford's law in Cash Flow Statements for Nelt Co doo



Source: Authors

Table 4 provides a comparative analysis of Benford's law for the mill-bakery and confectionery industries. In this case, the same procedure was applied as in the previous two cases, with the fact that the figures are presented collectively for all companies from one and the other industry in order to compare them. Their results can be seen in the table by columns: First, Count, Actual, Benford Law, Difference, AbsDiff and Z-statistics.

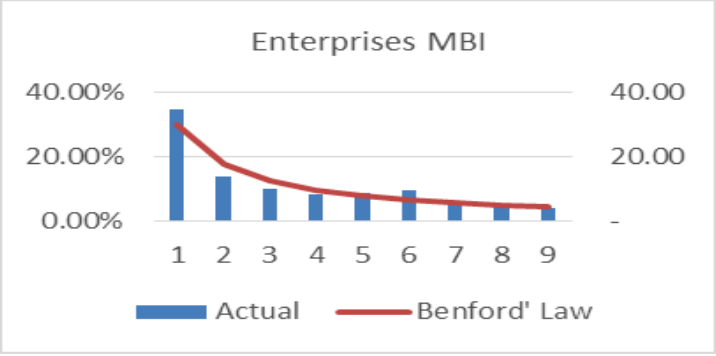
Table 4. Benford's Comparative Analysis of Cash Flow Statements for Mill-Bakery and Confectionery Industry Enterprises

Enterprises of the milling and baking industry (MBI)						
First	**Count**	**Actual**	**Benford' Law**	**Difference**	**AbsDiff**	**Z-stat**
1	133	34,37	30,10%	0,043	0,042639	0,216642
2	53	13,70	17,61%	-0,039	0,039140	0,194327
3	39	10,08	12,49%	-0,024	0,024164	0,41901
4	32	8,27	9,69%	-0,014	0,014223	0,4206
5	34	8,79	7,92%	0,009	0,008674	0,40028
6	37	9,56	6,69%	0,029	0,028660	0,181041
7	23	5,94	5,80%	0,001	0,001440	0,022586
8	20	5,17	5,12%	0,001	0,000527	0,37728
9	16	4,13	4,58%	-0,004	0,004414	0,31425
Enterprises of confectionery industry (CI)						
First	**Count**	**Actual**	**Benford' Law**	**Difference**	**AbsDiff**	**Z-stat**
1	141	35,25	30,10%	0,051	0,051470	0,340056
2	64	16,00	17,61%	-0,016	0,016091	0,2784
3	35	8,75	12,49%	-0,037	0,037439	0,28869
4	30	7,50	9,69%	-0,022	0,021910	0,32783
5	35	8,75	7,92%	0,008	0,008319	0,30533
6	24	6,00	6,69%	-0,007	0,006947	0,30355
7	25	6,25	5,80%	0,005	0,004508	0,1137
8	19	4,75	5,12%	-0,004	0,003653	0,24777
9	27	6,75	4,58%	0,022	0,021743	0,25082

Source: Authors

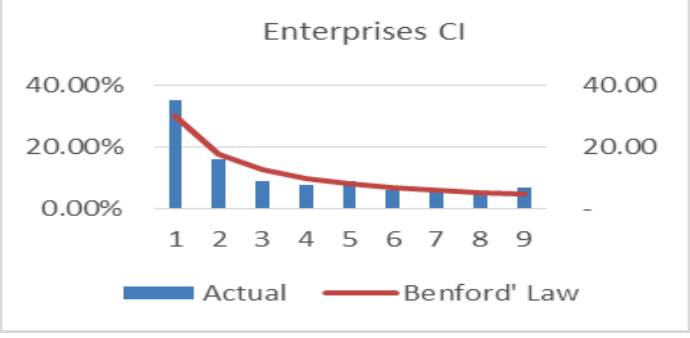
The results in Table 4 show that in all enterprises of the mill-bakery and confectionery industry (collectively) the first digits in real measurement are approximately logarithmically distributed with the highest probability of occurrence of the digit 1 of 30.10%, and with the lowest frequency of occurrence of the digit 9 out of 4 .58%, thus confirming Benford's law. However, as the comparative analysis shows, the biggest deviations of the appearance of the first digits in the mill-bakery industry companies refer to digits 2 and 6, while in the confectionery industry companies, these deviations refer to digits 1 and 3. However, these deviations are not statistically significant, which is why they are not shaded, as can be seen in the graphs that follow:

Figure 11. Deviations of the actual number from the expected number in the first digits of the Cash Flow Statements for companies in the mill-bakery industry (aggregate)



Source: Authors

Figure 12. Deviations of the actual number from the expected number in the first digits of the Cash Flow Statements for companies in the confectionery industry (aggregate)



Source: Authors

The obtained results show that, based on the overall comparison of companies in the mill bakery and confectionery industry, there are no significant deviations in relation to Benford's analysis, which is also shown graphically. This indicates that the Cash Flow Statements at the level of these two branches are realistically presented, which

is a good indicator for shareholders who want to invest their funds. Although the analysis done individually at the level of each company of these two industries shows different deviations, the shown difference occurred because the set of included data is (collectively) larger, i.e. data from the Cash Flow Report of all companies are included.

In addition, the level of the obtained results depends on the realized incomes and expenses, on the basis of which there is an inflow and outflow of cash flows. However, business, investment and financial activities that provide information on money flows should be included in the analysis in the business assessment, and therefore represent important indicators that should be taken into account when determining the difference between these two industries. Together, these activities affect the change in balance sheet positions in two successive accounting periods and show the sources (receipts) and uses (issues) of cash.

Conclusion

The authors presented the application of Benford's law on specific data on the cash flows of large and medium-sized enterprises in the milling, baking and confectionery industry in Serbia. This research was carried out precisely on the basis of the analysis of cash payments and payments for each company, because the movement of cash flows most realistically represents the financial condition of a company.

This analysis can be expanded, so it can be applied in other branches of the food industry as well as in other economic activities (agriculture, construction, tourism, etc.). In addition, it can be applied in analyzing macroeconomic data at the level of the economy of a country. Accordingly, Rauch, by applying Benford's law, cast doubt on the macroeconomic data of the Greek economy that were sent from this country as it entered the European Union (Rauch et al., 2011).

However, what many authors should keep in mind is that financial statement fraud does not necessarily occur if the data does not conform to Benford's law. Accidental errors or omissions in data entry may also occur (Milojević et al., 2014). Nevertheless, Benford's law is a powerful analytical tool for forensic application used by forensic auditors and forensic accountants in expert proceedings to detect fraud in court proceedings. It should be borne in mind that Benford's analysis is free from subjectivity when examining the possibility of errors in financial data, and it should be borne in mind that the greater the number of data, the more accurate the results (Kruger & Yadavalli, 2017).

The advantage of this analysis is that it can cover a larger number of time periods and that it flags suspicious data by observing the entire set on a large number of companies and financial institutions (Deckert et al., 2011). A deviation from Benford's Law is a red flag for auditors and forensic accountants to conduct a more detailed examination of a particular position. Finally, this analysis is considered a relevant indicator of data illogic that is applied in many countries around the world as a useful tool in detecting manipulations and contributing to quality financial reporting.

Based on the presented comparative results between mill-bakery and confectionery industry companies, the authors conclude that the observed companies present their Cash Flow Statements in accordance with legal regulations. A deeper analysis of individual balance sheet and profit and loss positions can determine the liquidity and solvency of given companies in the mill-bakery and confectionery industry, which also affects the results presented in Benford's analysis.

Quality financial reporting in the mentioned industries reduces the risk of presenting false financial information to auditors and potential investors. All of this affects the correct decision-making of financial information users and thus contributes to the creation of a stable environment in modern business conditions. Preservation of macroeconomic and financial stability represents the main indicators for the economic growth and development of Serbia.

Conflict of interests

The authors declare no conflict of interest.

References

1. Amiram, D., Bozanic, Z., & Rouen, E. (2015). Financial Statement Errors: Evidence from the Distributional Propertiesof Financial Statement Numbers. *Review of Accounting Studies*, 20(4), 1540-1593. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2374093 (September, 10, 2023)
2. Basrak, B., & Varga, I. (2013). Benfordov zakon. *Math.e*, Hrvatski matematički elektronički časopis, 23(1), 1-6. [*in English*: Benford's Law, *Math.e*, Croatian mathematical electronic magazine, 23(1), 1-6]. Retrieved from https://hrcak.srce.hr/file/175512 (September, 12, 2023)
3. Belopavlović, G. (2014). Uloga forenzičkog računovodstva u detekciji računovodstvenih prevara. Međunarodna naučna konferencija Univerziteta Singidunum *Finiz – Finansijsko izveštavanje u funkciji korporativnog upravljanja, str. 128-130, [in English: Belopavlović, G. (2014). The role of forensic accounting in detecting accounting frauds.* Singidunum University International Scientific Conference *Finiz – Financial reporting Function of the corporate governance, pp. 128-130], DOI: 10.15308/finiz-2014-128-130*
4. Benford, F. (1938). The law of anomalous numbers. *Proceedings of the American Philosophical Society, 78(4), 551-572. Retrieved from* https://www.jstor.org/stable/984802 (September, 28, 2024)
5. Berger, A., & Hill, T. P. (2011). A basic theory of Benford's Law. *Probability Surveys*, vol. 8, pp. 1-126, DOI: 10.1214/11-PS175
6. Cvetković, D., & Bošković, V. (2018). Pojavni oblici kreativnog računovodstva i najčešće manipulacije u finansijskim izveštajima. *Oditor*, 4(2), 78-89, [*in English*: Cvetković, D. & Bošković, V. (2018). Forms of creative accounting and most of manipulation in financial statements. *Oditor*, 4(2), 78-89]. Retrieved from https://scindeks-clanci.ceon.rs/data/pdf/2217-401X/2018/2217-401X1802078C.pdf (Oktober, 10, 2023)

7. Cvetković, D. (2023). Benfordov zakon - alat i korektor u računovodstvu i reviziji. *Revizor*, 26(2) 135-147, [*in English*: Banford's law – tool for accounting and auditing, *Auditor*, 26(2) 135-147], DOI: 10.56362/Rev23102135C
8. Deckert, J., Myagkov, M., & Ordeshook, C. P. (2011). Benford`s Law and the Detection of Election Fraud. *Political Analysis*, 19(3), 245-268, doi:10.1093/pan/mpr014
9. Diekmann, A., & Ben, J. (2010). Benford's Law and Fraud Detection: Facts and Legends. *German Economic Review*, 11(3), 397-401. Retrieved from https://www.researchgate.net/publication/297825048_Benford%27s_Law_and_Fraud_Detection_Facts_and_Legends (September, 28, 2023)
10. Durtschi, C., Hillison, W., & Pacini, C. (2004). The Effective Use of Banford`s Law to Assist in Detecting Fraud in Accounting Data. *Journal of Forensic Accounting*, vol. 5, pp. 17-34, Edwards, Inc. Retrieved from http://lycofs01.lycoming.edu/~sprgene/M400/BenfordsLaw.pdf (September, 15, 2023)
11. Halilčević, E. (2019). Metode otkrivanja prevara u finansijskim izveštajima, Zbornik radova sa naučno stručne konferencije *"FIRA 2019" - Finansijsko-računovodstvena i revizorska profesija u funkciji jačanja tržišne ekonomije*, Sveučilište/Univerzitet "Vitez", Travnik, BIH, 217-227, [*in English*: Halilčević, E. (2019). Methods of detecting of fraud in the financial statements, Proceedings of the scientific professional conference *"FIRA 2019" - Financial accounting and auditing profession in the function of strengthening the market economy*, University "Vitez", Travnik, BIH, 217-227]. Retrieved from https://unvi.edu.ba/Files/Fira2019/ZBORNIK%20RADOVA%20FIRA2019.pdf (September, 18, 2023)
12. Hoopwood, W., Leiner, J. J., & Young, R. G. (2014). *Forenzičko računovodstvo. Univerzitet Singidunum, Beograd, Srbija, [in English: Hoopwood, W., Leiner, J. J., & Young, R. G. (2014). Forensic accounting.* University Singidunum, Belgrade, Serbia]
13. Jukić, O., & Muhurdarević, N. (2003). Benfordov zakon, 3. Naučno-stručni skup sa međunarodnim učešćem - *Kvalitet 2003*, Zenica, BiH, 107-116, [*in English*: Jukić, O., & Muhurdarević, N. (2003). Benford's Law, 3th Scientific expert conference with international participation - *Quality 2003*, Zenica, BiH, 107-116]. Retrieved from http://www.quality.unze.ba/zbornici/QUALITY%202003/016-R-059.pdf (September, 12, 2023)
14. Kaisher, M. (2019). Benford`s law as an indicator of survey realiability - can we trust our data?, *Journal of Economic Surveys, 33(5), 1602-1618,* doi: 10.1111/joes.12338
15. Kossovsky, A. E. (2014). *Benford's Law: Theory, the General Law of Relative Quantities, and Forensic Fraud Detection Applications*. World Scientific Publishing, Singapore.
16. Kruger, S. P., & Yadavalli, S. S. V. (2017). The Power of One: Benford's Law. *South African Journal of Industrial Engineering*, 28(2), 1-13, DOI http://dx.doi.org/10.7166/28-2-1753
17. Lagarias, J., & Soundararajan, K. (2006). Benford`s law for the $3x+1$ function. *Journal of the London Mathematical Society*, 74(2), 289-303, doi.org/10.1112/S0024610706023131

18. Miller, J. S. (2015). *Benford`s Law: Theory and Applications*. Princeton University Press, Princeton, New Jersey.
19. Miller, J. S., Berger, A., Hill, P. T. (2010). *Theory and Applications of Benford's Law*, Princeton University, pp. 5-19.
20. Milojević, I., Andžić, R., & Vladisavljević, V. (2018). Accounting aspects of auditing the budget system. *Economics of Agriculture*, 65(1), 337-348, doi:10.5937/ekoPolj1801337M
21. Milojević, M., & Terzić, I. (2013). Uticaj međunarodne regulative na finansijsko izveštavanje kompanija posmatrano sa aspekta stalne imovine, 14. Međunarodni naučni skup *Sinergija*, str. 176-183, [*in English*: Milojević, M., & Terzić, I. (2013). Impact of international regulatiory framework of financial reporting company taken from the aspect of fixed assets. 14th International Scientific Conference *Synergy*, pp. 176-183].
22. Milojević, M., Terzić, I., & Marjanović, V. (2014). Primena Benfordovog zakona u otkrivanju anomalija u finansijskim izveštajima - slučaj velikih preduzeća u Srbiji. Međunarodna naučna konferencija *Sinteza*, str. 564-570, [*in English*: Milojević, M., Terzić, I., & Marjanović, V. (2014). Application of Benford's law in detecting anomalies in the financial statements – Case of Serbian large companies. International Scientific Conference *Synthesis*, pp. 564-570], DOI: 10.15308/SINTEZA-2014-564-570
23. Mrvaljević, M., Kojić, N., & Mitić, N. (2022). Prevare i manipulacije u finansijskim izveštajima i mogućnosti za njihovu relativizaciju. *Ekonomski signali: poslovni magazin*, 17(1), 137-149, [*in English*: Mrvaljević, M., Kojić, N., & Mitić, N. (2022). Frauds and manipulation in financial statements and opportunities for their relativization. *Economic signals: business magazine*, 17(1), 137-149], DOI: 10.5937/ekonsig2201137M
24. Newcomb, S. (1881). Note on the Frequency of Use of the Different Digits in Natural Numbers. *American Journal Mathematics*, 4(1), 39-40. https://doi.org/10.2307/2369148. Retrieved from https://www.jstor.org/stable/2369148 (September, 20, 2024)
25. Nigrini, J. M. (2012). *Benford's Law: Applications for Forensic Accounting, Auditing, and Fraud Detection*. John Wiley & Sons, New Jersey.
26. Petrović, D., Radosavac, A., & Mashovic, A. (2023). Implications of applying fair value accounting to modern financial reporting. *Journal of Process Management and New Technologies*, 11(1-2), 22-33, doi.org/10.5937/jpmnt11-44074
27. Rauch, B., Goettsche, M., Braehler, G., & Engel, S. (2011). Fact and Fiction in EU - Governmental Economic Data. *German Economic Review*, 12(3), 243-255, doi.org/10.1111/j.1468-0475.2011.00542.x
28. Singleton, T., Singleton, A., Bologna, J., & Lindquist, R. (2006). *Fraud Auditing and Forensic Accounting. John Wiley & Sons, New Jersey.*
29. Tödter, K-H. (2009). Benford's Law as an Indicator of Fraud in Economics. *German Economic Review*, 10(8), 339-351, DOI: 10.1111/j.1468-0475.2009.00475.x

30. Walthoe, J. (1999). *Looking out for number one*, pp. 1-9. Retrieved from https://plus.maths.org/issue9/features/benford/2pdf/index-gifd.html/op.pdf (September, 24, 2023)
31. Wang, L., & Ma, B.-Q. (2023). A concise proof of Benford`s law. *Fundamental Research*, pp. 1-4, doi.org/10.1016/j.fmre.2023.01.002
32. Watrin, C., Struffert, R., & Ullmann, R. (2008). Benford's Law: An Instrument for Selecting Tax Audit Targets?, *Review of Managerial Science*, vol. 2, pp. 219-237, doi.org/10.1007/s11846-008-0019-9

ECONOMIC ANALYSIS OF THE POSSIBILITIES FOR BUSINESS PROCESSES IMPROVEMENT IN SERBIAN DAIRY INDUSTRY

Milan Mihajlovic[1], Toma Dasic[2], Svetlana Mihic[3]

**Corresponding author E-mail: svetlana.mihic@educons.edu.rs*

ARTICLE INFO

Original Article

Received: *12 April 2024*

Accepted: *15 June 2024*

doi: 10.59267/ekoPolj250133M

UDC 338.439.4:637.1(497.11)

Keywords:

business process management, maturity models, economic analysis, dairy industry, Serbia

***JEL**: M11, M21,M390, D24, L6, L66,*

ABSTRACT

The objective of the research is to analyze the maturity model of business process management, evaluate the importance of the factors that form the basis of the model, as well as the mutual influence of certain factors on the level of maturity of business process management. In accordance with the set objective, a survey of 13 factors critical for the successful implementation of process orientation in dairy industry companies in the Republic of Serbia was conducted. A structured questionnaire containing 85 questions divided by factors and the use of Delphi method, enabled us to single out crucial factors, i.e. factors with a higher level of maturity. Based on the level of development of the observed factors and the correlation between these factors, a model was formed that can influence the increase in maturity of factors at a lower level.

Introduction

The maturity model of business process management enables the diagnosis of the level of maturity of the company, in terms of deployment and acceptance of the process approach. The level of maturity is determined by the elements and factors critical to the successful implementation of Business Process Management (BPM). Once an organization has defined their "as-is" condition, they are the best positioned to establish their BPM roadmap. (Dharmawan et al., 2019) Balanced management of these factors and their continuous improvement means greater maturity, and hence a quantitatively and qualitatively higher level of business process results, i.e. the companies in

1 Milan Mihajlovic, Assistant professor, Faculty of Business Economics, Vojvode Putnika 87, 21202 Sr.Kamenica, Serbia, Phone: 0214893610, E-mail: milan.mihajlovic@educons.edu.rs, ORCID ID (https://orcid.org/0000-0001-6472-5973)

2 Toma Dasic, Assistant, Academy of Professional Studies South Serbia, Vlade Jovanovica 8, 16000 Leskovac, Serbia, Phone: 016 254-961, E-mail: dasic.toma@vpsle.edu.rs, ORCID ID (https://orcid.org/0000-0002-7728-0616)

3 Svetlana Mihic, Full Professor, Faculty of Business Economics, Vojvode Putnika 87, 21202 Sr. Kamenica, Serbia, Phone: 0214893610, E-mail: svetlana.mihic@educons.edu.rs, ORCID ID (https://orcid.org/0000-0002-4221-685X)

which they are implemented. Modern chains must be organized in order to respond to the challenges posed by intense competition and by consumers, whose increased expectations regarding price and quality becomes of great importance, as they are able to choose from a number of products offered by competing chains. (Dasic et al., 2022)

Maturity models show the evolution of the company, through individual stages, on the way to business quality improvement, and their main purpose is to describe the stages and paths of process maturation of the company. When it comes to their application in practice, maturity models make it easier to identify the gap between the current and desired level of maturity, as well as the abilities that need to be improved to bridge this gap. Therefore, it can be said that their purpose is to diagnose and develop the skills needed to increase the quality performance. (Mihajlović et al., 2021)

Since the launch of the first maturity model, named Capability Maturity Model – CMM, whose application has been confirmed (Paulk et al., 1993), a large number of maturity models have emerged, proposed by theorists and practitioners from different research fields. (Maull et al., 2003; Fisher, 2004; Rosemann & De Bruin 2005; Hammer, 2007; Weber et al., 2008; McCormack et al. 2009; Van Looy et al., 2011). The maturity model proposed by Fisher is based on five domains, or as he calls them, "Five Levers of Change." By articulating the core characteristics of each Lever of Change in the context of each state of maturity, companies can quickly assess where they stand from a maturity perspective for each of the Levers of Change. (Fisher, 2004).

One of the best known is the model formulated by Rosemann and de Bruin (2005), which is known as Business Process Management Maturity Model. At the heart of this model there are six factors, identified based of the Delphi study, which are critical for the successful implementation of business processes, such as strategic alignment, process management, employee management, methods, information technology, and culture. (Radosavljević, 2015)

Hammer's Process and Enterprise Maturity Model – PEMM (Hammer, 2007) can measure the organization's level of process maturity by selecting specific processes and measuring the organization's level of process management maturity as a whole. (Correia et al., 2021) Within this model, the maturity of the following factors is estimated: (a) Leadership, (b) Culture, (c) Expertise, and (d) Governance. Each of these factors is subdivided as follows: Leadership contains Awareness, Alignment, Behavior, Style; Culture consists of Teamwork, Customer focus, Responsibility, Attitude Toward Change; within the Expertise factor are People, Methodology; while the maturity level of the Governance factor is established through the maturity of the Process model, Accountability.

Based on the Delphi-method-based maturity model (McCormack et al., 2007), a survey was conducted (Willaert et al., 2007) based on 68 questions related to eight different factors: (1) customer orientation; (2) process view; (3) organizational structure; (4) process performance; (5) culture, values and beliefs; (6) people management; (7) information technology; and (8) supplier orientation (Willaert et al., 2007)

Each of the mentioned models contains a defined level of maturity, however, in this paper the emphasis is on maturity factors as well as the possibility of influencing certain factors, i.e. their maturity, on other factors in order to raise the overall maturity of the organization. As many maturity models either do not have or offer only limited guidelines on how these models can be applied in improving process capabilities or refer to certain domains and situations specific to the organization, the aim of this paper is to propose the model as one of the ways of applying the maturity model.

Materials and methods

The survey was conducted on a stratified sample of 14 companies. The following criteria were used for selecting dairies from which data were requested: the importance of individual participants in the raw milk purchase market, installed production capacities and their position in regional market segments of production and processing of milk and dairy products. Also, it was necessary to ensure that the aggregated data, from dairies selected as above, form a representative sample, i.e. that they had adequate significance and weight from the aspect of their aggregate share in the aggregate data on the total quantity of purchased and processed milk in the Republic of Serbia. Strata are divided according to market share, installed capacities and number of employees, to three groups of dairies, "large" (3), "medium" (3) and "small" (8) with a total market share between 70-80%

The study covered 13 factors critical to the successful implementation of process orientation: strategy, leadership, process management, employee management, information technology, communication, customer focus, supplier relations, employee skills, reward system, continuous improvement, methods and techniques, performance measures. Based on a structured questionnaire containing 85 questions divided by factors and using Delphi methods, the following results were obtained (Table 1).

Process management	Processes within the company are defined and documented with clearly defined inputs/outputs	-	21.4	21.4	21.4	35.7	1.451	3.94
	Processes are described using flowcharts or process maps	-	21.4	14.3	7.1	57.1	1.692	
	Process performance measures are clearly defined	-	-	42.9	14.3	42.9	,923	
	Process performance is measured through quality, time and cost metrics	-	-	35.7	21.4	42.9	,841	
	Process performance is measured in terms of user satisfaction, employee satisfaction and financial contribution	-	-	42.9	28.6	28.6	,747	
	Process performance control is seen as a condition for their improvement	-	-	28.6	42.9	28.6	,615	
Management of employees	Jobs require performing a large number of multi-dimensional (complex) tasks	-	-	28.6	35.7	35.7	,687	3.97
	Employees can independently solve problems at the workplace (they have the necessary knowledge and skills)	-	-	42.9	35.7	21.4	,643	
	Employees are stimulated to suggest ideas for improving work processes based on their own observations	-	-	7.1	50.0	42.9	,401	
	Traditional control replaced by self-control (employees realize that every mistake they make has a negative impact on customer satisfaction)	-	-	35.7	42.9	21.4	,593	
	Employees are considered an important source of information	-	-	28.6	28.6	42.9	,747	
	In order to improve the process, employees are inclined to teamwork (collaboration and communication).	-	-	7.1	50.0	42.9	,401	
	Employees are involved in decision-making, their ideas are considered and, eventually, accepted	-	-	14.3	71.4	14.3	,308	
	The commitment and support of the management is intensive in removing the cultural characteristics that are a barrier to change	-	7.1	28.6	28.6	35.7	,995	
	The relationship between managers and subordinates is described as friendship at a distance (trust and mutual respect).	-	-	7.1	50.0	42.9	,401	
	The employees' attitude towards changes is "why not try something different", not "why change the existing ones"	-	28.6	28.6	28.6	14.3	1.143	
	Mistakes are acknowledged and not covered up	-	7.1	50.0	35.7	7.1	,571	
	The abilities of the employees are not ignored, but on the contrary they are used and further developed	-	-	28.6	35.7	35.7	,687	
Information technology	Information is collected, processed and visually presented	-	14.3	7.1	42.9	35.7	1.077	3.44
	Information is presented visually in all processes, in those that add value, but also in administrative processes	14.3	14.3	21.4	21.4	28.6	2.093	

	Data collection technology and IT systems make it possible to make decisions based on data and information in real time	-	42.9	14.3	14.3	28.6	1.758	
	Bar codes, sensors and RFID are used to track the entire value creation flow	35.7	14.3	-	7.1	42.9	3.610	
	The company orders electronically from its suppliers	21.4	14.3	7.1	21.4	35.7	2.709	
	The information system of the enterprise supports the management of the distribution process	-	42.9	7.1	-	50.0	2.264	
Communication	Internal communication about the methodology and achieved results is intensive	-	28.6	7.1	21.4	42.9	1.720	4.25
	There is a two-way flow of work reports between superiors and subordinates	-	-	-	57.1	42.9	,264	
	Employee communication takes place formally and informally	-	-	7.1	14.3	78.6	,374	
	Employees from different functional organizational units perform tasks while respecting the mutual alignment of goals	-	-	14.3	57.1	28.6	,440	
	Employees from different functional organizational units consult each other when necessary	-	-	21.4	42.9	35.7	,593	
	Managers of different functional organizational units meet frequently to coordinate mutual activities	-	-	21.4	28.6	50.0	,681	
Focus on customers	The company works to identify customer needs	-	-	-	21.4	78.6	,181	4.47
	Employees have a good understanding of customers' needs and keep customer expectations in mind at every operational stage	-	-	-	71.4	28.6	,220	
	Customer feedback is used to improve business processes	-	-	-	21.4	78.6	,181	
	Customer satisfaction is constantly monitored and processes are designed according to their suggestions	-	21.4	14.3	14.3	50.0	1.610	
	Products and services are developed in accordance with the needs and expectations of customers	-	-	-	50.0	50.0	,269	
	The company is successful in retaining existing and attracting new customers	-	-	7.1	50.0	42.9	,401	
	The number of customer complaints has significantly decreased compared to the previous year	-	-	7.1	21.4	71.4	,401	
Supplier relations	The company has established long-term partnership relations with suppliers	-	-	-	50.0	50.0	,269	4.04
	The company connects with suppliers at the level of business processes and closely cooperates with them	-	7.1	42.9	21.4	28.6	,989	
	The company formally informs suppliers about changes in business processes	-	35.7	21.4	14.3	28.6	1.632	

	The number of complaints from companies to suppliers has significantly decreased compared to the previous year	-	-	-	50.0	50.0	,269	
	Suppliers are open to suggestions from businesses	-	-	14.3	57.1	28.6	,440	
Knowledge and skills of employees	Employees have the necessary knowledge and skills to perform tasks	-	-	-	21.4	78.6	,181	3.39
	Employees exchange and share knowledge with each other	-	-	-	35.7	64.3	,247	
	Employees constantly improve their knowledge formally and informally	7.1	7.1	-	42.9	42.9	1.209	
	Employees attend trainings in the field of motivation (developing communication skills, techniques for overcoming stress, accepting changes)	50.0	21.4	-	21.4	7.1	2.132	
	Employees acquire new knowledge from the use of computer technologies	35.7	28.6	7.1	14.3	14.3	2.264	
	Employees acquire new knowledge from traditional external sources (seminars, conferences, trainings, publications...)	35.7	21.4	14.3	14.3	14.3	2.269	
	Employees are trained to use certain methods and techniques in order to improve business processes	-	50.0	14.3	14.3	21.4	1.610	
Reward system	Employees are rewarded with other financial compensations (eg bonuses) besides salary	-	7.1	21.4	21.4	50.0	1.055	3.61
	As a variable part of the compensation, the bonus is determined based on the achieved performance	-	-	35.7	7.1	57.1	,951	
	As a variable part of the compensation, the bonus is determined on the basis of performance improvement	-	21.4	21.4	35.7	21.4	1.187	
	In addition to fixed and variable, there are also non-financial compensations determined on the basis of the achieved performance for all employees	-	7.1	35.7	14.3	42.9	1.148	
	The compensation package also includes non-financial compensation	-	42.9	-	14.3	42.9	2.110	
	If necessary, awards are also made at the team level	35.7	14.3	14.3	14.3	21.4	2.681	
	The reward system is transparent and fair	-	42.9	21.4	14.3	21.4	1.516	
Continuous improvement	Improvements are seen as a natural way of doing business in the company	-	-	-	64.3	35.7	,247	3.95
	The company is familiar with the PDCA cycle of continuous improvement of business processes	28.6	7.1	14.3	14.3	35.7	2.951	
	The company is constantly working on reducing wastage	-	-	-	57.1	42.9	,264	
	The company is continuously working on discovering and eliminating bottlenecks	-	-	7.1	35.7	57.1	,423	
	Appropriate tools are applied in order to improve business processes	-	50.0	7.1	-	42.9	2.247	

	The company is constantly working on identifying places and opportunities to improve the process	-	14.3	28.6	14.3	42.9	1.363	
Methods and techniques	The company applies a process flow diagram (visual representation of the process).	-	21.4	21.4	7.1	50.0	1.670	2.73
	Developing the quality function - the house of quality (development or redesign of products according to customer requirements) is an integral part of the company's operations	42.9	-	-	35.7	21.4	3.148	
	The company uses Statistical Process Management (control charts, Pareto diagram...) for data presentation and analysis	21.4	-	28.6	-	50.0	2.725	
	An Ishikawa diagram (fishbone diagram) is used to investigate all possible causes of certain problems.	61.5	-	7.7	15.4	15.4	2.859	
	The company knows the Six Sigma methodology	53.8	7.7	-	15.4	23.1	3.269	
	Lean tools are applied in the company's operations	61.5	7.7	-	7.7	23.1	3.192	
	The Taguchi method was applied in the company	61.5	15.4	-	-	23.1	2.910	
Performance measures	Performance is measured at the process level	-	35.7	14.3	14.3	35.7	1.808	3.27
	The company complements traditional measures of process performance with modern measures	-	35.7	14.3	21.4	28.6	1.648	
	Some of the performance measurement indicators are used at the process level (SCOR, BSC...)	46.1	7.7	-	15.4	30.8	3.526	
	Data obtained from performance measurement is used not only for error correction and error prevention	-	38.4	7.7	23.1	30.8	1.769	
AVERAGE								3.65

Source: Authors' own calculations

Results

Starting from the selected factors critical for the successful implementation of the process orientation, as well as identification of their level of development and interdependence, it is possible to formulate a framework for improving the quality of business processes of dairy companies in the Republic of Serbia. The tables below show average values, i.e. the level of development of the observed maturity factors of process management (Table 2), and then the correlation between these factors (Table 3).

Table 2. Average values

Factors	Minimum	Maximum	Avg	Standard dev.
Strategy	2.20	5.00	3.6429	1.10155
Leadership	1.86	5.00	3.3846	1.29807
Process management	2.67	5.00	**3.9405**	.89301
Management of employees	3.00	4.92	**3.9702**	.63851
Information technology	1.50	5.00	3.4405	1.35181
Communication	3.00	5.00	**4.2500**	.68485
Focus on customers	3.57	5.00	**4.4694**	.47024
Supplier relations	3.20	5.00	**4.0429**	.68468
Staff	2.43	4.86	3.3878	.91289
Reward system	2.14	5.00	3.6122	1.07990
Continuous improvements	2.67	5.00	3.7524	.89736
Methods and techniques	1.14	5.00	2.7363	1.55056
Performance measures	1.75	5.00	3.2692	1.46295

Source: Authors' own calculations

Table 3 Process management maturity factors correlation

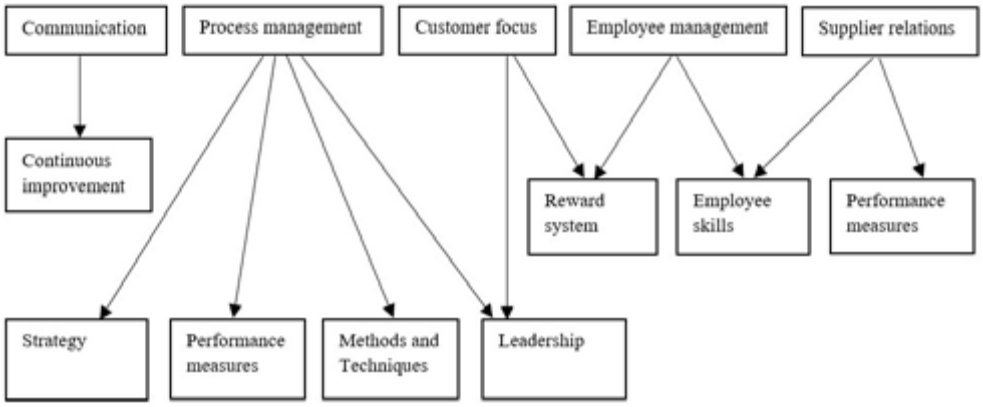
	Strategy	Management	Process management	Management of employees	Inf. Technology	Communication	Focus on customers	Supplier relations	Staff	Reward system	Cont. improvements	Methods and techniques	Performance measures
Correlation coefficient	1,000	.966**	.943**	.797**	.954**	.844**	.891**	.903**	.865**	.955**	.947**	.952**	.934**
Sig. (2-tailed)	.	.000	.000	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000
Strategy													
Correlation coefficient	.966**	1,000	.992**	.806**	.976**	.892**	.912**	.872**	.816**	.989**	.934**	.968**	.902**
Sig. (2-tailed)	.000	.	.000	.001	.000	.000	.000	.000	.001	.000	.000	.000	.000
Management													
Correlation coefficient	.943**	.992**	1,000	.859**	.986**	.807**	.911**	.869**	.831**	.981**	.904**	.965**	.891**
Sig. (2-tailed)	.000	.000	.	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Process management													
Correlation coefficient	.797**	.806**	.859**	1,000	.813**	.694**	.859**	.750**	.844**	.847**	.798**	.735**	.752**
Sig. (2-tailed)	.001	.001	.000	.	.000	.006	.000	.002	.000	.000	.001	.004	.003
Management of employees													
Correlation coefficient	.954**	.976**	.986**	.813**	1,000	.762**	.875**	.906**	.848**	.968**	.892**	.972**	.932**
Sig. (2-tailed)	.000	.000	.000	.000	.	.002	.000	.000	.000	.000	.000	.000	.000
Inf. Technology													
Correlation coefficient	.844**	.892**	.807**	.694**	.762**	1,000	.790**	.615*	.581*	.799**	.925**	.843**	.762**
Sig. (2-tailed)	.000	.000	.000	.006	.002	.	.001	.019	.029	.001	.000	.000	.002
Communication													
Correlation coefficient	.891**	.912**	.911**	.859**	.875**	.790**	1,000	.804**	.847**	.911**	.856**	.887**	.768**
Sig. (2-tailed)	.000	.000	.000	.000	.000	.001	.	.001	.000	.000	.000	.000	.002
Focus on customers													
Correlation coefficient	.903**	.872**	.869**	.750**	.906**	.615*	.804**	1,000	.938**	.899**	.830**	.879**	.977**
Sig. (2-tailed)	.000	.000	.000	.002	.000	.019	.001	.	.000	.000	.000	.000	.000
Supplier relations													
Correlation coefficient	.865**	.816**	.831**	.844**	.848**	.581*	.847**	.938**	1,000	.861**	.807**	.796**	.898**
Sig. (2-tailed)	.000	.001	.000	.000	.000	.029	.000	.000	.	.000	.000	.001	.000
Staff													
Correlation coefficient	.955**	.989**	.981**	.847**	.968**	.799**	.911**	.899**	.861**	1,000	.903**	.950**	.906**
Sig. (2-tailed)	.000	.000	.000	.000	.000	.001	.000	.000	.000	.	.000	.000	.000
Reward system													
Correlation coefficient	.947**	.934**	.904**	.798**	.892**	.925**	.856**	.830**	.807**	.903**	1,000	.881**	.900**
Sig. (2-tailed)	.000	.000	.000	.001	.000	.000	.000	.000	.000	.000	.	.000	.000
Continuous improvement													
Correlation coefficient	.952**	.968**	.965**	.735**	.972**	.843**	.887**	.879**	.796**	.950**	.881**	1,000	.900**
Sig. (2-tailed)	.000	.000	.000	.004	.000	.000	.000	.000	.001	.000	.000	.	.000
Methods and techniques													

Source: Authors' own calculations

Finally, on the basis of the data presented in Tables 2 and 3, a framework for improving the quality of business processes was formulated (Figure 1). As can be observed, the leading factors of maturity of dairy companies in the Republic of Serbia are:

communication, process management, customer focus, employee management and supplier relations.

Figure 1. Framework for improving the quality of business processes



Source: Authors' presentation

Leading maturity factors of process management were identified based on average values of factors. As these factors have the highest average values (which are also followed by the lowest standard deviations) they have been identified as leading factors. Based on the correlation coefficients of the leading and other factors, factors were identified that can be "pulled" by the leading factors in order for them to reach a higher level of maturity, which is, ultimately, a condition for improvement of the maturity of the company as a whole. It is up to companies to develop an action plan to operationalize the correlations shown in Figure 1, i.e. to identify how statistically identified correlations can be used to increase the company processes management quality and thus increase the maturity of the company as a whole.

Conclusions

Business process management maturity models contain a number of factors whose level of maturity (development, quality) should be measured, monitored and improved, in order to increase the level of maturity of process-based management. These models should be used by organizations to analyze the strengths and weaknesses of their current business processes and develop "future" models to achieve the organization's business goals. In fact, BPMM should be a guide for organizations in achieving business goals by applying the model in practice.

The paper presents a model with 13 factors critical for the successful implementation of process orientation, whose level of maturity must be planned, measured, analyzed and improved, in order to increase the level of maturity of process-based management. The special contribution of this paper is reflected in proposing a model that does not focus

only on a particular maturity factor, the contribution of a particular factor, or the level of its maturity, but considers the interplay between factors and the possibility of raising the level of maturity of factors that are at a lower level under influence of factors that are at a higher level of maturity. By operationalizing the correlations between factors at higher and those at lower maturity level, through well-prepared and implemented action plans, an increase in the maturity of factors at a lower level can be influenced, and therefore an increase in the maturity of the company as a whole.

Future research may focus on establishing a causal model that is specific to a particular organization or different business sector. In any case, the study carried out as well as the model presented should help organizations in understanding and meeting the necessity of continuous improvement and raising the quality of business processes.

Conflict of interests

The authors declare no conflict of interest.

References

1. Correia, A.M.M., da Veiga, C. P., Senff, C. O., Duclos, L. C., (2021) Analysis of the Maturity Level of Business Processes for Science and Technology Parks, SAGE Open, https://doi.org/10.1177/21582440211037303
2. Dharmawan, Y. S., Divinagracia, G. G., Woods, E., Kwong, B., (2019) Inter-dependencies on BPM Maturity Model Capability Factors in Deriving BPM Roadmap, *Procedia Computer Science*, Science Direct, The Fifth Information Systems International Conference, Volume 161, Pages 1089-1097, https://doi.org/10.1016/j.procs.2019.11.220
3. Dašić, T., Mihić, S., & Šmelcerović, M. (2022). Application of holistic marketing in the formulation of a business concept of agricultural producers from south Serbia. *Economics of Agriculture*, 69(4), 1109-1124. https://doi:10.5937/ekoPolj2204109D
4. Fisher, M. (2004) The Business Process Maturity Model: A Practical Approach for Identifying Opportunities for Optimization, *BP Trends*, 9: 1-7.
5. Hammer M., (2007). The Process Audit, *Harvard Business Review*, 85(4), pg. 111-123.
6. Maull, S., Tranfield, D., Maull, W., (2003) Factors characterising the maturity of BPR programmes, *International Journal of Operations & Production Management* 23(6): 596-624
7. McCormack, K. (2007), *Business Process Maturity: Theory and Application*, DRK Research, Raleigh, NC.
8. McCormack, K., Willems, J., van den Bergh, J., Deschoolmeester, D., Willaert, P., Indihar Štemberger, M., Škrinjar, R., Trkman, P., Marcelo Bronzo Ladeira, B. M., de Oliveira, P. V. M., Bosilj Vuksic, V., Vlahovic, N., (2009). A global investigation of key turning points in business process maturity, *Business Process Management Journal* 15(5): 792–815. http://dx.doi.org/10.1108/14637150910987946

9. Mihajlović, M., Tadić, J., Jotić, J., (2021), Implementation of Quality Management System and ahe level of Maturity of the Company in the Dairy Industry of Serbia, *Ekonomika* LXVII, VII-IX 2021, Vol. 3, ISSN 0350-137X, Society of Economists "Ekonomika", Nis, pg 63-74
10. Paulk M. C., Curtis B., Chrissis M. B., Weber C. V., (1993) *The capability maturity model for software, Version 1.1* (No. CMU/SEI-93-TR-24). Software engineering institute, Pittsburgh, PA
11. Radosavljević, M., (2015) Process Orientation as a basis for increasing Supply Chain Management Maturity, *Economic Themes* 53 (3): 397-413 http://doi10.1515/ethemes-2015-0023
12. Rosemann, M., De Bruin, T., (2005). Application of a holistic model for determining BPM maturity, *BP Trends* 2: 1–21.
13. Van Looy, A., De Backer, M., Poels, G., (2011) Defining business process maturity: A journey towards excellence, *Total Quality Management & Business Excellence* 22 (11): 1119-1137
14. Weber C., Curtis B., Gardiner T., (2008). *Business Process Maturity Model version 1.0*. Needham, MA
15. Willaert, P., van den Bergh, J., Willems, J., Deschoolmeester, D. (2007), The process-oriented organisation: a holistic view. Developing a framework for business process orientationmaturity, *5th International BPM Conference,* Brisbane, September 24-27, pp. 24-7.

ASSESSING THE SATISFACTION LEVEL OF RURAL TOURIST HOUSEHOLDS (RTH) IN SERBIA WITH THE ECONOMIC SUSTAINABILITY DIMENSION

Katica Radosavljević[1], Vesna Paraušić[2], Branko Mihailović[3], Danijela Pantović[4]

**Corresponding author E-mail: danijela.durkalic@kg.ac.rs*

ARTICLE INFO

Original Article

Received: *28 May 2024*

Accepted: *05 June 2024*

doi:10.59267/ekoPolj250145R

UDC 005.6:338.48-44(1-22)
(497.11)

Keywords:

rural tourist households, economic sustainability, economic efficiency, agro-tourism, socio-economic development.

***JEL**: O18, R51, Z32, L83, Q56*

ABSTRACT

The aim of the research is to examine the economic efficiency of rural tourist households in the Republic of Serbia engaged in rural tourism at their households. To achieve the research goal, two dependent variables were observed: (1) satisfaction with tourist visits and accommodation capacity occupancy, and (2) satisfaction with earnings from rural tourism and the possibility of investment return in this activity. The non-parametric Kruskal–Wallis test was employed to examine differences between groups. The research revealed no statistically significant difference in the level of satisfaction with tourist visits and capacity occupancy among respondents with different demographic, socio-economic, and business characteristics. Regarding satisfaction with income from rural tourism and the possibility of investment return in rural tourism among respondent groups, the application of the Kruskal–Wallis test detected differences only based on the Age of the respondents and Dominant sources of income in the rural tourist household.

Introduction

Although all the natural, cultural, and social conditions for its development already exist (natural resources, significant agricultural land, a high percentage of agriculturally active population, traditional agricultural practices, lack of soil pollution and the

1 Katica Radosavljević, Ph.D., Senior Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 69 8066 384, E-mail: katica@ekof.bg.ac.rs, ORCID ID (https://orcid.org/0000-0002-5609-8399)

2 Vesna Paraušić, Ph.D., Senior Research Associate, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 63 15 36 21 76, E-mail: vesna_pa@iep.bg.ac.rs, ORCID ID (https://orcid.org/0000-0001-6193-5297)

3 Branko Mihailović, Ph.D., Scientific Adviser, Institute of Agricultural Economics, Volgina Street no. 15, 11060 Belgrade, Serbia, Phone: +381 11 697 28 58, E-mail: brankomih@neobee.net, ORCID ID (https://orcid.org/0000-0002-2398-6568)

4 Danijela Pantović, Ph.D., Assistant professor, Faculty of Hotel Management and Tourism Vrnjačka Banja, University of Kragujevac, Vojvođanska Street No. 5A, 36210 Vrnjačka Banja, Serbia,, Email: danijela.durkalic@kg.ac.rs, ORCID ID (https://orcid.org/0000-0001-8605-8614)

potential for the production of "healthy food," good potential for the development of complementary activities like hiking, recreation, hunting, fishing, horseback riding, participation in locals' daily activities, tasting traditional local gastronomic specialties, etc.), Serbia's level of competitiveness in the field of rural and agro-tourism is currently not particularly high.

In many European Union countries, rural tourism is integrated into strategies for the development of regions and rural areas, which helps retain the population in place, create new jobs, and contribute to the socio-economic advancement of underdeveloped areas. (Muhi, 2013). The growth of rural tourism can contribute to the economic development of rural areas, and the industry's synergistic development can be facilitated by objective analysis of rural tourism (Dong, 2022).

The training of rural hosts to participate in this activity is one of the most crucial responsibilities in the development of agrotourism and rural tourism. The study's objective is to determine how satisfied Serbian rural tourist household (RTH) operators are with the financial aspect of sustainable rural tourism on their properties.

This dimension of sustainability is represented through two dependent variables: (1) satisfaction with tourist visits and occupancy rates of accommodation facilities, and (2) satisfaction with income generated from rural tourism and the ability to recoup investments made in this activity. Additionally, the authors investigate whether attitudes regarding the examined variables differ between groups of respondents with different demographic and socio-economic characteristics.

Literature review

Research on sustainable livelihoods in tourism contexts has primarily concentrated on the following areas: analyzing the sustainable livelihoods of rural households in various tourism communities, such as ethnic and heritage tourism sites (Su et al., 2016a; Yajuan et al., 2016); improving and refining the framework for sustainable livelihoods in tourism context (Su et al., 2019; Shen et al., 2008; Su et al., 2016b); analyzing the external effects of rural tourism livelihoods (Nyaupane & Poudel, 2011; Josimović et al., 2024), and quantitatively analyzing the impact of tourism development on the framework's components from social, economic, and human perspectives, especially on livelihood capital (Wang et al., 2021), livelihood strategies (He et al., 2014), and livelihood outcomes (Cui et al., 2017; Lazović et al., 2024).

It is evident from earlier research that the sustainable livelihoods framework has developed into a useful instrument for examining the social and economic circumstances of rural households in rural tourist locations (Hua & Yuxiang, 2020). Through semi-structured interviews and questionnaires, the study of Agustin at all assesses how competitive communities are as tourist destinations (Agustin et al., 2022; Josimović et al., 2024).

Rural tourism development can have indirect effects on the economy in addition to direct ones, like increasing villagers' income levels. It can also raise government tax

revenues, feed the populace through dividends and subsidies, and strengthen farmers' capacity through free vocational training (Scheyvens, 2007; Lapeyre, 2010).

In actuality, additional elements from the destination's stakeholders may have an impact on the sustainability of their means of subsistence (Rodríguez Díaz, Espino Rodríguez, 2016). Agro-tourism provides development opportunities for small businesses that would otherwise be unprofitable in rural communities with low population density.

Additionally, agro-tourism aligns with existing rural enterprises, such as family farms, helping them generate secondary income. (Wilson et al, 2001). Numerous rural households have included tourism into their livelihood plan as a result of changes brought about by economic requirements and efforts to reduce poverty in rural areas (Iorio & Corsale, 2010; Snyder & Sulle, 2011; Wu & Pearce, 2014; Nyaupane & Poudel, 2011).

The studies that follow, which concentrate on how tourism affects household livelihoods, have grown in (Ashley, 2000; Melita & Mendlinger, 2013; Nepal, 1997; Anup & Parajuli, 2014; León, 2007). The desire and need to return to roots and a simpler way of life, devoid of complex organization, stress, and urban environments, is leading to increasing interest in rural areas" (Kastenholz et al., 1999).

The relative technological stagnation of our agricultural production (extensive production methods, low use of mineral fertilizers, reduced pesticide consumption, etc.) could align with the global trend (production and consumption of healthy organic food) and could overnight become a significant competitive advantage and form of differentiation for Serbia's tourism products (Djenadić, 2012).

Jiang suggests that future research should address different avenues for integrating agritourism with agricultural eco-efficiency (Jiang, 2022). Identifying different categories of potential visitors (e.g., families, seniors, young people, active tourists, tourists with special interests, etc.) plays a crucial role in creating an appropriate offering. Each of these visitor categories has different preferences, interests, and requirements, making it necessary to develop diverse offerings and services for each of these segments in agro-tourism (Muhi, 2013).

Materials and methods

To address the research objective, the authors conducted a survey using an online questionnaire managed through Google Forms software. The sample included respondents who are operators of rural tourist households (RTH) in the Republic of Serbia. Questionnaires were sent to all households, and 132 responses were received. Since some respondents did not complete the survey or provide feedback, it is considered a non-random error, specifically an error due to non-response. The questionnaire contained numerous questions related to rural tourism activities on RTHs, but for the purposes of this study, only a subset of these questions was utilized.

To examine the level of satisfaction of respondents with the economic dimension of sustainability in rural tourism activities and to determine if there are differences based on groups of respondents with different demographic and socio-economic characteristics, two dependent variables (DVs) were formed:

1. DV 1: Occupancy rates (satisfaction with tourist visits);
2. DV 2: Income generated and return on investment (satisfaction with income from rural tourism and the ability to recoup investments in rural tourism).

Respondents rated these variables on a Likert scale from 1 to 5 (1: Not satisfied; 2: Slightly satisfied; 3: Moderately satisfied; 4: Satisfied; 5: Extremely satisfied). Simultaneously, as independent variables based on which different groups of respondents were formed, the following variables on a nominal scale were analyzed:

1. Gender of the person/persons most engaged in rural tourism;
2. Age of the respondents most engaged in rural tourism;
3. Education of the person most involved in rural tourism;
4. Experience in rural tourism (years spent in rural tourism);
5. Capacity size (number of individual beds per household);
6. Rural tourism as a type of activity (the only profitable activity on the household or additional/supplementary profitable activity)
7. Tourist content at the rural tourist household;
8. Dominant sources of income in the rural tourist household;
9. Beneficiaries of incentives for the development of rural tourism.

In addition to descriptive statistical analysis, various methods of statistical inference were used. For examining differences between groups in the level of the DV1 variable, as well as in the level of the DV2 variable, the non-parametric Kruskal–Wallis test (an alternative to one-way ANOVA) was employed. The factor under consideration is one of the 9 independent variables listed.

This test is utilized for comparing the medians of three or more independent groups, testing the null hypothesis that k (k>2) independent samples belong to the same underlying population. The null hypothesis (H_0) states that there is no difference in medians among the underlying populations to which the samples belong, while the alternative hypothesis (H_1) states that there is a difference in medians. The statistic for the Kruskal-Wallis test is obtained through the formula (Cohen, J., 1998).

$$H = \left[\frac{12}{n(n+1)} \sum_{i=1}^{k} \frac{T_i^2}{n_i} \right] - 3(n+1)$$ where:

,

k – is the number of samples or basic groups being analyzed;

n_i – is the number of elements in the i-th sample;

n – is the total number of elements in all samples;

T_i – is the sum of ranks in the i-th sample.

The distribution of the H statistic can be approximated by the chi-square distribution with $k-1$ degrees of freedom. Therefore, practically, the difference in medians between three or more basic groups can be tested using the chi-square test. If the obtained p-value is less than 0.05, the null hypothesis is rejected. In the case of comparing the medians of two basic groups or two groups of respondents, the Mann-Whitney U test was used for inference. The statistic for the Mann-Whitney U test is:

$$U_1 = n_1 n_2 + \frac{n_2(n_2+1)}{2} - R_1, U_2 = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_2$$

The Mann-Whitney U test is a non-parametric test in which the data in each group are first ordered from lowest to highest. Values in the entire data set, from both the control and treated groups, are then ranked, with the average rank being assigned to tied values as it is for the Wilcoxon rank-sum test. The ranks are then summed for each group, and U is determined:

where n_1, n_2 are the sample size for control and treated groups, respectively; R_1, R_2 are the sum of ranks for the control and treated groups; and U_1, U_2 *are* the Mann-Whitney statistic for both groups. In the research, we combined both samples and ranked the data. The test statistic is the smaller sum between the sum of ranks of one sample and the sum of ranks of the other sample.

For the application of tests (Kruskal-Wallis and Mann-Whitney U test), basic assumptions were met (random, independent samples belong to continuous populations; data are available in the form of ranks, i.e., on an ordinal measurement scale). The choice of these tests was conditioned by the nature of the research. Namely, for assessing the level of satisfaction of respondents with various dimensions of the economic sustainability of rural tourism, given the data available at the ordinal and nominal measurement scales, the application of non-parametric methods proved to be the most suitable.

Results and Discussion

The sample consists of 132 respondents, operators of rural tourist households (RTH) in Serbia. Although formally and legally, the provision of accommodation and hospitality services at RTH can be conducted by a company, another legal entity, an entrepreneur, and/or an individual, all respondents except one identified themselves as individuals engaged in rural tourism. Only one respondent was based in the Belgrade region, 10 in the Vojvodina region, 78 in the Šumadija and Western Serbia region, and 43 in the Southern and Eastern Serbia region. This sample structure territorially corresponds to the distribution of RTH in Serbia.

The structure of respondents according to nominal variables is presented in Table 1.

Table 1. Structure of the sample

Sample characteristics	No	Structure (%)
I Region		
– Beogradski region	1	0.8
– Region Vojvodina	10	7.6
– Šumadija i Zapadna Srbija	78	59.1
– Južna i Istočna Srbija	43	32.6
Total	**132**	**100.0**
II Gender of person/persons most engaged in rural tourism		
– Female	77	58.3
– Male	36	27.3
– Both (male and female are included in business)	19	14.4
Total	**132**	**100.0**
III Age range of the respondents		
– Young (≤40)	25	19.7
– Middle aged (41-64)	77	60.6
– Older (≥65)	25	19.7
Total	**127**	**100.0**
IV Education of the person who is most involved in rural tourism		
– Primary school	11	8.3
– High school	75	56.8
– Higher school, faculty, master's degree, doctorate	46	34.8
Total	**132**	**100.0**
V Experience in rural tourism (years spent in rural tourism)		
– Beginners and less experienced (<5)	41	31.1
– Middle experienced (5-14)	56	42.4
– Very experienced (≥15)	35	26.5
Total	**132**	**100.0**
VI Capacity size (number of individual beds per household)		
– Small size capacity (1-4 beds)	30	22.7
– Middle size capacity (5-9 beds)	62	47.0
– Large size capacity (10 and more beds)	40	30.3
Total	**132**	**100.0**
VII Rural tourism from the perspective of sources of household income		
– Basic activity (the only profitable activity on the household)	32	24.2
– Additional (supplementary) profitable activity	100	75.8
Total	**132**	**100.0**
VIII Tourist content		
– Accommodation only	42	31.8
– Full board (accommodation with food and beverage servise)	49	37.1
– Full board and other activities (organization of excursions, bicycle rental/quad rental; use of the swimming pool and etc.)	41	31.1
Total	132	100.0
IX Dominant sources of income in the rural tourist household		

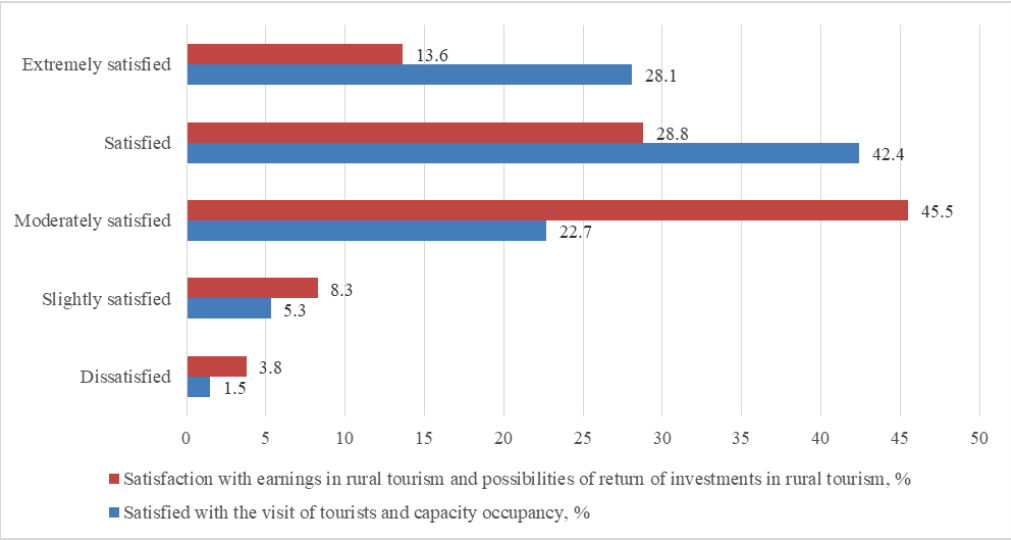
Sample characteristics	No	Structure (%)
– Exclusively salary from the employment relationship	28	21.2
– Pension only	18	13.6
– Exclusively income from rural tourism	24	18.2
– Other sources of income (remittances from abroad, agricultural production, etc.)	18	13.6
– Combination of different previously mentioned sources of income	44	33.3
Total	132	100.0
X Beneficiaries of incentives for the development of rural tourism		
– Beneficiaries of incentives	70	53.0
– Not beneficiaries of incentives	62	47.0
Total	132	100.0

Source: Author's presentation based on the survey

All respondents (132 of them) provided ratings for the dependent variables on the Likert scale, and Figure 1 shows the response scale. A total of 70.5% of respondents are either satisfied or extremely satisfied with tourist visits and occupancy rates (42.4% are satisfied, with 28.1% of them being extremely satisfied).

At the same time, satisfaction with the earning potential in rural tourism and the rate of return on investment in this business activity is slightly lower. With this economic dimension of engaging in rural tourism, the highest percentage of respondents (45.5%) is only moderately satisfied (Figure 1).

Figure 1. Assessment of the economic sustainability of rural tourism engagement, respondents' response scale, %.



Source: Authors' calculation

The average rating of the first dependent variable (Occupancy rates, i.e., satisfaction with tourist visits) is 3.9, with the Median and Mode having the same value (4). The Interquartile Range (IQR) is 2, indicating that 50% of respondents' central responses ranged from a rating of 3 to the maximum rating of 5.

The second variable exhibits slightly less favorable values, indicating a lower level of satisfaction among respondents with this dimension of economic sustainability in rural tourism activities or engagement in rural tourism. Specifically, the average rating of the second dependent variable is 3.4, with the Median and Mode having a lower value (3), and the IQR is 1, indicating that 50% of respondents' central responses ranged from a rating of 3 to 4. Below are the results of testing the hypothesis whether the medians of the observed dependent variables differ between groups of respondents with different demographic and socio-economic characteristics using the Kruskal–Wallis test and Mann-Whitney U test (Table 2).

Table 2. Testing differences in the values of dependent variables between groups of respondents

Independent/ predictive variables	Dependent variable 1	Dependent variable 2
Gender of the person/persons most engaged in the tasks of running a rural tourist household	Gp1, n=77: Female; Gp2, n=36: Male; Gp3, n=19: Female & male; c^2 (2, n=132)=1.543, *p*=0.462 No statistical significance*	Gp1, n=77: Female; Gp2, n=36: Male; Gp3, n=19: Female & male; c^2 (2, n=132)=3.418, *p*=0.181 No statistical significance*
Age of the respondents	Gp1, n=25: Young (≤40); Gp2, n=77: Middle aged (41-64); Gp3, n=25: Older (≥65) c^2 (2, n=127)=0.698, *p*=0.706 No statistical significance*	Gp1, n=25: Young (≤40); Mean rank=79.12; Md=4.0; Gp2, n=77: Middle aged (41-64); Mean rank=63.24; Md=3.0; Gp3, n=25: Older (≥65); Mean rank=51.22; Md=3.0; c^2 (2, n=127)=8.328, ***p*=0.016** **Statistical significance***
Education of the person/persons who are most engaged in the tasks of running a rural tourist household	Gp1, n=11: Primary school; Gp2, n=75: High school; Gp3, n=46: Higher school, faculty, master's degree, doctorate; c^2 (2, n=132)=1.276, *p*=0.528 No statistical significance*	Gp1, n=11: Primary school; Gp2, n=75: High school; Gp3, n=46: Higher school, faculty, master's degree, doctorate; c^2 (2, n=132)=1.934, *p*=0.380 No statistical significance*
Experience (years of dealing in rural tourism)	Gp1, n=41: Beginners and less experienced (<5 years); Gp2, n=56: Middle experienced (5-14 years); Gp3, n=35: Very experienced (≥ 15 years); c^2 (2, n=132)=3.991, *p*=0.136 No statistical significance*	Gp1, n=41: Beginners and less experienced (<5 years); Gp2, n=56: Middle experienced (5-14 years); Gp3, n=35: Very experienced (≥ 15 years); c^2 (2, n=132)=0.925, *p*=0.630 No statistical significance*

Capacity size (number of individual beds per household)	Gp1, n=30: Small size capacity (1-4 beds); Gp2, n=62: Middle size capacity (5-9 beds); Gp3, n=40: Large size capacity (≥ 10 beds) c^2 (2, n=132)=2.535, *p*=0.282 No statistical significance*	Gp1, n=30: Small size capacity (1-4 beds); Gp2, n=62: Middle size capacity (5-9 beds); Gp3, n=40: Large size capacity (≥ 10 beds) c^2 (2, n=132)=3.126, *p*=0.210 No statistical significance*
Rural tourism as a type of activity	Group 1, n=32: Basic activity (the only profitable activity on the household); Group 2, n=100: Additional (supplementary) profitable activity U=1376.0, z= -1.261, *p*=0.207 No statistical significance*	Group 1, n=32: Basic activity (the only profitable activity on the household); Group 2, n=100: Additional (supplementary) profitable activity U=1417.5, z= -1.034, *p*=0.301 No statistical significance*
Tourist content	Gp1, n=42: Accommodation only; Gp2, n=49: Full board (accommodation with food and beverage servise); Gp3, n=41: Full board and other activities c^2 (2, n=132)=0.735, *p*=0.692 No statistical significance*	Gp1, n=42: Accommodation only; Gp2, n=49: Full board (accommodation with food and beverage servise); Gp3, n=41: Full board and other activities c^2 (2, n=132)=0.958, *p*=0.619 No statistical significance*
Dominant sources of income in the rural tourist household	Gp1, n=28: Exclusively and only salary; Gp2, n=18: Pension only; Gp3, n=24: Exclusively and only income from rural tourism; Gp4, n=18: Other (remittances from abroad, agricultural production, other); Gp5, n=44: Combination of different previously mentioned sources of income; c^2 (4, n=132)=4.552, *p*=0.336 No statistical significance*	Gp1, n=28: Exclusively and only salary, Mean rank=72.91, Md=3.5; Gp2, n=18: Pension only, Mean rank=46.33, Md=3.0; Gp3, n=24: Exclusively and only income from rural tourism, Mean rank=76.46, Md=4.0; Gp4, n=18: Other (remittances from abroad, agricultural production, other), Mean rank=55.61, Md=3.0; Gp5, n=44: Combination of different previously mentioned sources of income, Mean rank=69.69, Md=3.0; c^2 (4, n=132)=10.445, ***p*=0.034** **Statistical significance***
Beneficiaries of incentives for the development of rural tourism	Group 1, n=70: Beneficiaries of incentives; Group 2, n=62: Not beneficiaries of incentives; U=1984.5, z=-0.897, *p*=0.370 No statistical significance*	Gp 1, n=70: Beneficiaries of incentives; Gp 2, n=62: Not beneficiaries of incentives; U=2132.5, z=-0.182, *p*=0.855 No statistical significance*

*Source:*Author's presentation. *

* Significance level of 0.05.

In Table 2, the results of the Kruskal–Wallis and Mann-Whitney U tests for testing differences between different groups in the levels of the first and second dependent variables are presented.

In the second column of Table 2, the results for DV1 are provided.

If Gender of the person/persons most engaged in the tasks of running a rural tourist

household is considered as a factor, with levels (treatments) being: Male, Female, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., occupancy rates, because the p-value is >0.05.

1. If Age of the respondents is considered as a factor, with levels (treatments) being: Young, Middle aged, Older, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., occupancy rates, because the p-value is >0.05.
2. If Education of the person/persons who are most engaged in the tasks of running a rural tourist household is considered as a factor, with levels (treatments) being: Primary school, High school, Higher school, faculty, master's degree, doctorate, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., occupancy rates, because the p-value is >0.05.
3. If Experience (years of dealing in rural tourism) is considered as a factor, with levels (treatments) being: Beginners and less experienced, Middle experienced, Very experienced, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., occupancy rates, because the p-value is >0.05.
4. If Capacity size (number of individual beds per household) is considered as a factor, with levels (treatments) being: Small size capacity, Middle size capacity, Large size capacity, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., occupancy rates, because the p-value is >0.05.
5. If Rural tourism as a type of activity is considered as a factor, with levels (treatments) being: Basic activity (the only profitable activity on the household), Additional (supplementary) profitable activity, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., occupancy rates, because the p-value is >0.05.
6. If Tourist content is considered as a factor, with levels (treatments) being: Accommodation only, Full board (accommodation with food and beverage service), Full board and other activities, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., occupancy rates, because the p-value is >0.05.
7. If Dominant sources of income in the rural tourist household is considered as a factor, with levels (treatments) being: Exclusively and only salary, Pension only, Exclusively and only income from rural tourism, Other (remittances from abroad, agricultural production, other), Combination of different previously mentioned sources of income, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., occupancy rates, because the p-value is >0.05.
8. If Beneficiaries of incentives for the development of rural tourism is considered as a factor, with levels (treatments) being: Beneficiaries of incentives, Not beneficiaries of incentives, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., occupancy rates, because the p-value is >0.05.

It is concluded that there is no statistically significant difference in the values of the first dependent variable (DV1), i.e., the level of satisfaction with the visit of tourists and capacity occupancy, between groups of respondents with different demographic, socio-economic, and business characteristics.

Currently, the findings indicate that people view tourism's benefits favorably, seeing it as a means of obtaining work and elevating their standard of living. Because of the benefits that they personally derive from socio-cultural aspects (the advancement of arts and crafts, the enhancement of social life and amenities), a sizable portion of the rural population is willing to support the development of sustainable tourism.

The local population is open to supporting the growth of sustainable tourism as long as the perceived benefits are significant. The local community is more supportive of developing future tourist initiatives when perceived economic, sociocultural, and infrastructure benefits are strong.

In the second column of Table 2, the results for DV2 are provided.

1. If the factor observed is the Gender of the person/persons most engaged in the tasks of running a rural tourist household, with levels (treatments) being Male and Female, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., the earned income and return on investment, as the p-value > 0.05.
2. If the factor observed is the Age of the respondents, with levels (treatments) being Young, Middle aged, and Older, it is concluded that this factor affects the variability of the observed phenomenon, i.e., the earned income and return on investment, as the p-value < 0.05.
3. If the factor observed is the Education of the person/persons most engaged in the tasks of running a rural tourist household, with levels (treatments) being Primary school, High school, Higher school, faculty, master's degree, and doctorate, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., the earned income and return on investment, as the p-value > 0.05.
4. If the factor observed is the Experience (years of dealing in rural tourism), with levels (treatments) being Beginners and less experienced, Middle experienced, and Very experienced, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., the earned income and return on investment, as the p-value > 0.05.
5. If the factor observed is the Capacity size (number of individual beds per household), with levels (treatments) being Small size capacity, Middle size capacity, and Large size capacity, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., the earned income and return on investment, as the p-value > 0.05.
6. If the factor observed is the Rural tourism as a type of activity, with levels (treatments) being Basic activity (the only profitable activity on the household)

and Additional (supplementary) profitable activity, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., the earned income and return on investment, as the p-value > 0.05.

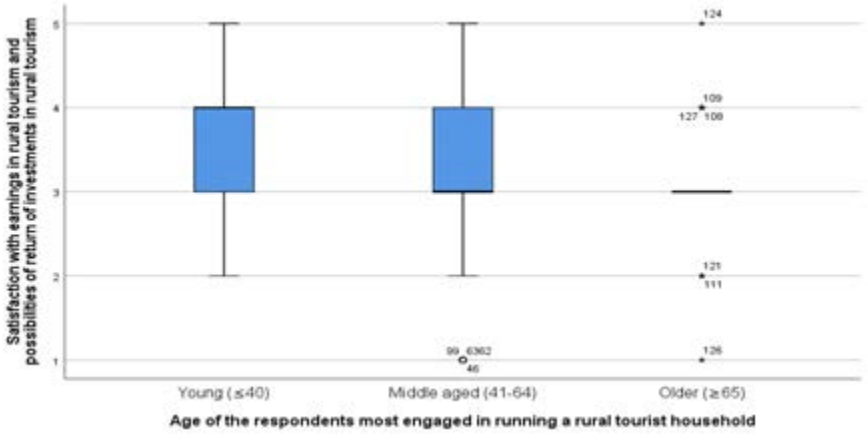
7. If the factor observed is the Tourist content, with levels (treatments) being Accommodation only, Full board (accommodation with food and beverage service), and Full board and other activities, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., the earned income and return on investment, as the p-value > 0.05.
8. If the factor observed is the Dominant sources of income in the rural tourist household, with levels (treatments) being Exclusively and only salary, Pension only, Exclusively and only income from rural tourism, Other (remittances from abroad, agricultural production, other), and Combination of different previously mentioned sources of income, it is concluded that this factor affects the variability of the observed phenomenon, i.e., the earned income and return on investment, as the p-value < 0.05.
9. If the factor observed is the Beneficiaries of incentives for the development of rural tourism, with levels (treatments) being Beneficiaries of incentives and Not beneficiaries of incentives, it is concluded that this factor does not affect the variability of the observed phenomenon, i.e., the earned income and return on investment, as the p-value > 0.05.

The Kruskal-Wallis test revealed differences in the degree of satisfaction with income from rural tourism and the possibility of investment return in rural tourism between groups of respondents based on two nominal variables (Table 2):

- Age of the respondents (p=0.016) and
- Dominant sources of income in the rural tourist household (p=0.034).

It is concluded that the Age of the respondents and Dominant sources of income in the rural tourist household influence the variability of the variable Income earned and return on investment.

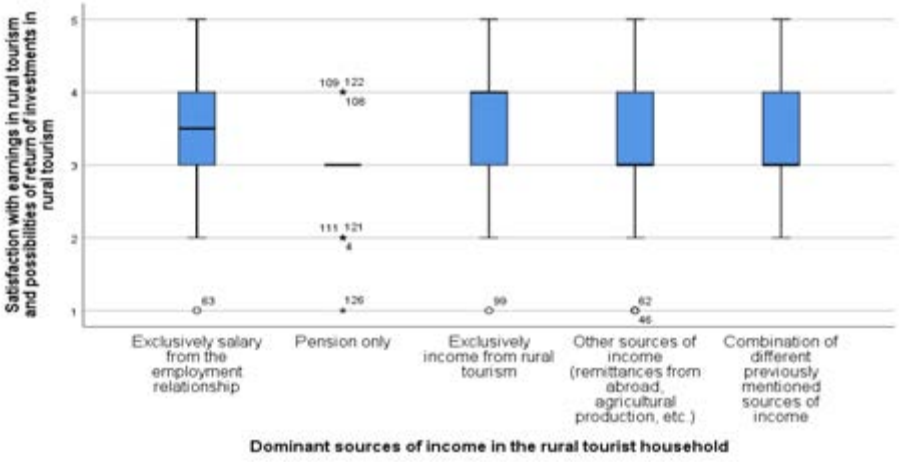
Figure 2. Box plot - The influence of the age of the respondents on the grades of DV 2



Source: Authors' calculation

Such a result can be explained by assuming that older individuals may lack the capacity, competencies, or various resources to enhance activities related to rural tourism, thereby increasing their income from this activity. Meanwhile, younger individuals possess greater enthusiasm, capacities, knowledge, as well as numerous and diverse competencies required in managing rural tourist households, leading to a higher level of satisfaction with income from this activity. Improving the economic efficiency of rural tourist households involves significant financial resources that can be obtained in various ways. Well-designed projects in tourism and tourist infrastructure would yield significant economic benefits and justify the investment of funds from the European Union.

Figure 3. Box plot-Influence of dominant sources of income on the household on ratings of DV 2.



Source: Authors' calculation

Table 3. The Interquartile Range (IQR) for DV 2 by the independent variable Dominant sources of income in the rural tourist household

	IQR	Percentiles (25, 75)
Gp1, n=28: Exclusively and only salary	1	3.0-4.0
Gp2, n=18: Pension only	0	2.75-3.0
Gp3, n=24: Exclusively and only income from rural tourism	1	3.0-4.0
Gp4, n=18: Other (remittances from abroad, agricultural production, other)	1	2.75-4.0
Gp5, n=44: Combination of different previously mentioned sources of income	1	3.0-4.0

Source: Authors' calculation

The result indicates that rural tourist household operators whose income is predominantly and solely from pensions rate their satisfaction with earnings from rural tourism and the possibility of investment return the least favorably. This can be attributed to various factors, starting from the high probability that the pension may not provide a satisfactory standard of living and the ability to invest in activities related to rural tourism, to the fact that these individuals are older and may not have the capacity to enhance activities related to rural tourism, thus affecting their earnings from this activity.

Conclusions

Local specificity and resource availability pose challenges in creating a universal model for the development of products and destinations in rural tourism (Mathieson & Vall, 1982). According to the Master Plan for Sustainable Development of Rural Tourism in Serbia (2011, p. 104), both villages and farms will require the following support framework:

- Definition of the concept and establishment of minimum criteria to be met to obtain official certification.
- Application process for certification or minimum characteristics required for participation in the support program to meet minimum standards.
- Awareness, training, and technical assistance to candidates for support schemes and for final certification.
- Subsidy scheme for villages and farms.
- Review and certification process.
- Promotion and commercialization process.

Taking into account the expressed economic and other functions of tourism, as well as diverse and highly valuable potentials, the opportunity and appropriate significance for the development of this sector are provided by the spatial plan of the Republic of Serbia and its economic policies. In addition, the Tourism Development Strategy in Serbia has established a selective approach, treating rural tourism as a priority among the forms of tourism related to special interests.

The ability of rural communities to reap financial rewards from the growth of tourism-related activities is referred to as rural tourism's economic efficiency. This sector

of tourism promotes the allure of rural locations for tourists while assisting in the sustainability of nearby populations and ecosystems. The following are some crucial elements of rural tourism's economic effectiveness:

1. Economic diversification: The local economy can become more varied thanks to rural tourism. Communities can rely on tourism as a source of revenue rather than just traditional sectors like agriculture.

2. Increasing household income: By offering lodging, food, tour services, and the chance to sell locally made goods and mementos, tourism gives locals a way to make money.

3. Job creation: As tourism grows in rural regions, jobs in the hotel and restaurant, tour guide, and artistic industries, among others, may be generated.

4. Raising Investment: Infrastructure, including roads, lodging facilities, dining establishments, and other tourist attractions, can draw investment from the tourism industry.

5. Preservation of cultural heritage: Rural tourism may support the upkeep of regional customs, traditions, and handicrafts, all of which enhance the appeal of the area to tourists.

6.Improving infrastructure: Local governments frequently need to make infrastructural improvements to fulfill the needs of tourists, which can also benefit the local populace.

7. Contribution to local consumption: When tourists stay in rural regions, they spend money on activities, food, souvenirs, and lodging, which helps the local

8. Reduction of seasonal unemployment: By creating jobs throughout the travel season, tourism can contribute to the reduction of seasonal unemployment.

9. Developing an identifiable destination: Fruitful rural tourism can help create a destination that draws new tourists and continues to boost economic growth.

However, it is important to emphasize that the economic efficiency of rural tourism requires a balance between economic benefits and the preservation of natural and cultural resources. A sustainable approach to tourism development in rural areas should be focused on the long-term preservation of resources and support for local communities.

The importance of non-agricultural parts of sustainable rural development is highlighted by developed countries' experience with the demographic and economic issues of rural areas. These include processing industries, local product commerce, indigenous crafts, and, most importantly, rural tourism.

The level of development of rural tourism in a country certainly depends on the overall socio-economic development. Therefore, the total income generated by rural tourism operators in our country is small and inadequate, but still significant from the perspective of individual rural households. A significant effect of rural tourism development can be the substantial involvement of female labor force in this type of activity.

Acknowledgements

This research is supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia by the Decision on the scientific research funding for teaching staff at the accredited higher education institutions in 2025 (No. 451-03-137/2025-03/200375 of February 4, 2025).

Conflict of interests

The authors declare no conflict of interest.

References

1. Agustin, E. S. A. S., Martini, R., & Setiyono, B. (2022). Evaluating rural tourism competitiveness: Application of PROMETHEE-GAIA method. *Cogent Economics & Finance*, *10*(1), 2054526. https://doi.org/10.1080/23322039.2022.2054526
2. Anup, K., Parajuli, R.B.T. (2014). Tourism and its impact on livelihood in Manaslu conservation area, Nepal. *Environment, development and sustainability*, *16*, https://doi.org/1053-1063. 10.1007/s10668-013-9512-7
3. Ashley, C. (2000). *The Impacts of Tourism on Rural Livelihoods: Namibia's Experience*; Overseas Development Institute: London, UK. Available at https://ashleyinsight.co.uk/wp-content/uploads/2020/04/namibia-impact-of-tourism-rural-livelihoods.pdf
4. Cohen, J. (1998). *Statistical power analysis for the behavioral sciences*. Second Edition. USA: Lawrence Erlbaum Associates. Available at https://www.utstat.toronto.edu/~brunner/oldclass/378f16/readings/CohenPower.pdf
5. Cui, X.; Chen, J.; Yang, X. (2017). Research on Sustainable Livelihoods Impacted by Rural Tourism A Case Study of Ankang in Qinling and Bashan Mountainous Areas. *Mt. Res.*, *35*, 85–94.
6. Dong, Y. (2022). A study of rural tourism development and tourism economic quality based on regional difference analysis. *International journal of sustainable development*, *25*(3-4), 285-297. https://doi.org/10.1504/IJSD.2022.127969
7. Djenadić, M. (2012). Marketing u hotelijerstvu, monografija, Draslar partner, Beograd. [in English: Djenadic, M. (2012). Marketing in the hotel industry, monograph, Draslar partner, Belgrade].
8. He, A.L., Yang, X.J., Chen, J., Wang, Z.Q. (2014). Impact of Rural Tourism Development on Farmer's Livelihoods—A Case Study of Rural Tourism Destinations in Northern Slop of Qinling Mountains. *Econ. Geogr.*, *34*, 174–181. https://doi.org/10.15957/j.cnki.jjdl.2014.12.026
9. Hua, G., & Yuxiang, Y. (2020). Research review of sustainable livelihood of rural tourism. *Tourism Tribune*, *35*(9), 134-148.
10. Iorio, M., & Corsale, A. (2010). Rural tourism and livelihood strategies in Romania. *Journal of rural studies*, *26*(2), 152-162. https://doi.org/10.1016/j.jrurstud.2009.10.006

11. Jiang, G. (2022). How does agro-tourism integration influence the rebound effect of China's agricultural eco-efficiency? An economic development perspective. *Frontiers in Environmental Science*, *10*, 921103. https://doi.org/10.3389/fenvs.2022.921103

12. Josimović, M., Ćoćkalo, D., & Radivojević, N. (2024). The role of guest loyalty between satisfaction with service recovery and guest behavior in mountain hotels. *Hotel and Tourism Management*, 12(2). https://doi.org/10.5937/menhottur2400012J

13. Kastenholz, E., Davis, D., & Paul, G. (1999). Segmenting tourism in rural areas: the case of North and Central Portugal. *Journal of Travel research*, 37(4), 353-363. https://doi.org/10.1177/004728759903700405

14. Lapeyre, R. (2010). Community-based tourism as a sustainable solution to maximise impacts locally? The Tsiseb Conservancy case, Namibia. *Development Southern Africa*, *27*(5), 757-772. https://doi.org/10.1080/0376835X.2010.522837

15. Lazović, S., Milićević, S., Đorđević, N., & Kraguljac, V. (2024). Exploring rural tourism potential in rural areas of Vrnjačka Banja. *Hotel and Tourism Management*, 12(2). https://doi.org/10.5937/menhottur2400007L

16. León, Y. M. (2007). The impact of tourism on rural livelihoods in the Dominican Republic's coastal areas. *The Journal of development studies*, *43*(2), 340-359. https://doi.org/10.1080/00220380601125214

17. Master plan održivog razvoja ruralnog turizma Srbije, 2011. [*in English*: Master plan for sustainable development of rural tourism in Serbia, 2011]. Available at: https://futurehospitalityleaders.files.wordpress.com/2012/11/master-plan-odrzivog-razvoja-ruralnog-turizma-u-srbiji.pdf

18. Mathieson, A., & Wall, G. (1982). *Tourism, economic, physical and social impacts*. Longman.

19. Melita, A. W., & Mendlinger, S. (2013). The impact of tourism revenue on the local communities' livelihood: A case study of Ngorongoro Conservation Area, Tanzania. *Journal of Service Science and Management*, *6*(1), 117-126. https://doi.org/10.4236/jssm.2013.61012

20. Muhi, B. (2013). Marketinški aspekti brending strategije seoskog turizma Vojvodine, časopis *Turističko poslovanje*, Visoka turistička škola Beograd no. 4, 93-103. [in English: Marketing aspects of the branding strategy of rural tourism of Vojvodina, journal *The Business of Tourism*, High School of Tourism Beograd no. 4, 93-103].

21. Nepal, S. K. (1997). Sustainable tourism, protected areas and livelihood needs of local communities in developing countries. *The International Journal of Sustainable Development & World Ecology*, *4*(2), 123-135. https://doi.org/10.1080/13504509709469948

22. Nyaupane, G. P., & Poudel, S. (2011). Linkages among biodiversity, livelihood, and tourism. *Annals of tourism research*, *38*(4), 1344-1366. https://doi.org/10.1016/j.annals.2011.03.006

23. Rodríguez Díaz, M., & Espino Rodriguez, T. F. (2016). Determining the sustainability factors and performance of a tourism destination from the stakeholders' perspective. *Sustainability*, *8*(9), 951. https://doi.org/10.3390/su8090951

24. Scheyvens, R. (2007). Exploring the tourism-poverty nexus. *Current issues in tourism*, *10*(2-3), 231-254. https://doi.org/10.2167/cit318.0

25. Shen, F., Hughey, K. F., & Simmons, D. G. (2008). Connecting the sustainable livelihoods approach and tourism: A review of the literature. *Journal of Hospitality and Tourism Management*, *15*(1), 19-31. https://doi.org/10.1375/jhtm.15.1.19

26. Snyder, K. A., & Sulle, E. B. (2011). Tourism in Maasai communities: a chance to improve livelihoods?. *Journal of Sustainable Tourism*, *19*(8), 935-951. https://doi.org/10.1080/09669582.2011.579617

27. Su, M. M., Wall, G., & Xu, K. (2016a). Tourism-induced livelihood changes at mount Sanqingshan world heritage site, China. *Environmental Management*, *57*, 1024-1040. https://doi.org/10.1007/s00267-016-0672-8

28. Su, M. M., Wall, G., & Xu, K. (2016b). Heritage tourism and livelihood sustainability of a resettled rural community: Mount Sanqingshan World Heritage Site, China. *Journal of Sustainable Tourism*, *24*(5), 735-757.

a. https://doi.org/10.1375/10.1080/09669582.2015.1085868

29. Su, M. M., Wall, G., Wang, Y., & Jin, M. (2019). Livelihood sustainability in a rural tourism destination-Hetu Town, Anhui Province, China. *Tourism Management*, *71*, 272-281. https://doi.org/10.1016/j.tourman.2018.10.019

30. Wang, R., Dai, M.L., Ou, Y.H., Ma, X.L. (2021). Measurement of rural households'livelihood assets with cultural capital intervention: A case study of Likeng village in Wuyuan. *Tourism Tribune*, *36*, 56–66.

31. Wilson, S., Fesenmaier, D. R., Fesenmaier, J., & Van Es, J. C. (2001). Factors for success in rural tourism development. *Journal of Travel research*, 40(2), 132-138. https://doi.org/10.1177/004728750104000203

32. Wu, M. Y., & Pearce, P. L. (2014). Host tourism aspirations as a point of departure for the sustainable livelihoods approach. *Journal of sustainable Tourism*, *22*(3), 440-460. https://doi.org/10.1080/09669582.2013.839689

33. Ya-juan, L.I., Hu, Y.U., Tian, C., Jing, H.U., Hai-yang, C. (2016). Livelihood changes and evolution of upland ethnic communities driven by tourism: A case study in Guizhou Province, southwest China. *Journal of Mountain Science 13*(7), 1313–1332. https://doi.org/10.1007/s11629-015-3631-6

WHOLESALE MARKETS AS SUPPLY CHANNELS FOR GREEN MARKETS AND THEIR IMPACT ON RURAL DEVELOPMENT IN SERBIA

Nedeljko Prdić[1], Tamara Gajić[2], Saša Stepanov[3]

**Corresponding author E-mail: nedeljko.prdic021@gmail.com*

ARTICLE INFO

Original Article

Received: *07 October 2024*

Accepted: *20 November2024*

doi:10.59267/ekoPolj250163P

UDC 339.132.4:725.27(497.11)

Keywords:

wholesale markets, green markets supply chain, rural development, innovation, vendor performance, consumer satisfaction, digital transformation, agricultural innovations

***JEL**: Q1, Q13, Q19*

ABSTRACT

The wholesale market is a key supply channel for green markets, linking producers and consumers locally and globally. This study explores challenges and opportunities for vendors, emphasizing wholesale markets' role in improving supply chain efficiency. Through in-depth interviews with vendors at Kvantaška Pijaca in Novi Sad and local green market sellers, a mixed-methods approach was used to assess economic and communication effects. Findings show strong alignment between vendor operations and consumer needs, highlighting wholesale markets' potential to enhance rural development through better market access and innovative distribution. The study contributes to literature on sustainable agriculture and offers practical recommendations to improve vendor performance and customer satisfaction. It provides a strategic framework for policymakers to support rural and agricultural development in Serbia.

Introduction

The wholesale market system plays a pivotal role in the distribution of agricultural products, serving as a critical link between producers and consumers (Kłoczko-Gajewska et al., 2024). In Serbia, the significance of wholesale markets extends beyond economic transactions,

1 Nedeljko Prdić, PhD, Associate professor, JKP Tržnica, 4 Žike Popovića, SRB-21000 Novi Sad, Serbia, Phone:+381 63 500 818, E-mail: nedeljko.prdic021@gmail.com, ORCID ID (https://orcid.org/0000-0003-3199-1188)

2 Tamara Gajć, Geographical Institute "Jovan Cvijić", Serbian Academy of Sciences and Arts, 11000 Belgrade, Republic of Serbia; Swiss School of Business and Management, Avenue des Morgines 12, 1213 Genève, Switzerland; Institute of Environmental Engineering, Peoples' Friendship University of Russia, RUDN University, Moscow, Russia, E-mail: tamara.gajic.1977@gmail.com, ORCID ID (https://orcid.org/0000-0003-3016-8368)

3 Saša Stepanov, Ph.D., Associate Professor, University of Economics Academy, Novi Sad, Faculty of Applied Management, Economics and Finance (MEF), 11000 Belgrade, Jevrejska Street no. 24/1, 11000 Belgrade, Serbia. Center for Research, Science, Education and Mediation, CINEP Belgrade, Phone: +38163237436; E-mail: sasa.stepanov@gmail.com, ORCID ID (https://orcid.org/0009-0002-6093-8589)

contributing to the preservation of local agricultural traditions and supporting the development of rural areas (Marin et al., 2024). However, despite their importance, these markets face challenges related to outdated infrastructure, insufficient integration with modern digital platforms, and a lack of strategic alignment between wholesale and green market vendors (FAO,2018; WUWM, 2022; Pantović et al., 2023). These gaps hinder the optimization of supply chains and the potential for achieving greater economic and social benefits.

This paper focuses on the issue of wholesale market allocation as a key factor for improving distribution channels and connecting rural and urban markets. The primary aim of this study is to explore the economic and communication effects of wholesale markets as key supply channels for green markets in Serbia. By addressing existing gaps in the literature, such as the limited understanding of vendor satisfaction, customer behavior, and the impact of digital transformation on traditional market systems, this research provides actionable insights for enhancing the performance and sustainability of wholesale markets. Furthermore, the study examines how innovative approaches in distribution and marketing can bridge the gap between rural production and urban consumption, fostering a more resilient agricultural sector.

This research contributes to the existing body of knowledge by presenting empirical evidence from a case study of the Kvantaška Pijaca market in Novi Sad and its relationship with local green markets. The study integrates theoretical frameworks and empirical findings to address the pressing need for modernization in wholesale markets. Its innovative approach lies in the application of digital tools and communication strategies to enhance the role of wholesale markets as drivers of rural development and consumer satisfaction. By focusing on the intersection of economic efficiency, customer satisfaction, and rural development, this study offers a novel perspective on the transformation of traditional market systems. The findings are expected to inform policymakers and market stakeholders, providing a framework for sustainable agricultural practices and highlighting the strategic importance of integrating innovation and digital transformation in wholesale market operations.

If wholesale markets are acknowledged as the oldest or among the oldest forms of wholesale trade throughout history, and as precursors to the digital transformation that bridges rural and urban areas, particularly in the trade of fruits and vegetables, we can assume the following scenarios:

C1. “Pure market situation of trade at wholesale markets”:

This situation is characterized by the absence or minimal level of competition, which aligns with the traditional role of wholesale markets. Under such conditions, there is no need to consider potential interdependencies in communication between wholesale markets and other retail establishments. The market position can be deemed realistic, as local agricultural products (fruits and vegetables) are predominantly sold at wholesale and green markets. The situation is considered objective when taking into account that vendors at green markets are most often supplied by wholesale markets, while consumers frequently visit green markets to purchase fresh products.

C2. Expanding the range of agricultural product sales:

New products introduced at wholesale markets offer advantages such as quality associated with geographical origin, freshness, competitive prices, and localized methods of production and design. Given the well-established fact that local agricultural products are primarily sold at wholesale and green markets, there is no need to further measure the impact of additional marketing communication tools. The sales effects and communication outcomes can be attributed to these markets. After three months of operation at the new Wholesale Market (Veletržnica in Novi Sad), consumer attitudes can be used to evaluate the market's impact.

C3. Establishing a sales position for agricultural products (fruits and vegetables) in new retail and wholesale facilities:

Traditionally, markets have been closely associated with the sale of a wide range of local products. This type of sales positioning is inherently linked to market-based sales activities. It also involves developing a distinctive role for markets as central hubs for the sale of local products.

C4. Market positioning of agricultural producers:

A vendor operating at a wholesale market who opens a new point of sale and takes proactive measures to inform customers implements specific strategies to increase sales volumes at the new location. This includes analyzing data on their own sales as well as the sales of other producers at the wholesale market.

Wholesale markets serve as priority distribution channels for sustainable agriculture and other rural production sectors, acting as a vital source of vitality for agricultural communities. Innovations in production and distribution are essential for survival and represent a foundation for market competitiveness. The distribution of agricultural products (fruits and vegetables) through wholesale markets offers a long-term advantage over competitors, achieved through the introduction of new or improved products or customer-oriented services.

In the context of wholesale markets, a modern sales approach involves adopting advancements in technology, fostering social relations, and enhancing public communication—factors that include direct customer engagement. In today's environment, creativity is required in the sale of fruits and vegetables, placing agriculture's natural potential at the center of these efforts. A successful trade strategy is intrinsically linked to fostering local rural development (Cvijanović et al., 2020).

The rapid development of agricultural technology and the increasing prevalence of digital communication with customers and the public have strengthened the position of wholesale markets as effective sales instruments globally. These attributes give wholesale markets an advantage over other distribution channels in supporting the development of green markets in the Republic of Serbia. The future of rural development in Serbia undoubtedly depends on the integration of new technologies, innovative methods, and advanced practices in production, sales, and distribution.

Literature overview

Wholesale markets have long been recognized as specialized institutions for the bulk trading of agricultural products, catering to a specific customer base that includes institutional buyers, wholesalers, and retailers (Prdić et al., 2019; Rustom et al., 2020). Kuzman et al. (2017) emphasize their pivotal role as the most critical distribution channel for agricultural products, while Inayah et al. (2024) highlight their capacity to facilitate the sale of large quantities of goods. However, this characterization often oversimplifies the complexity and variability inherent in wholesale markets, particularly regarding their adaptability to evolving market demands and integration with modern digital tools. Investments in wholesale markets are often portrayed as beneficial projects for enhancing market supply chains (Kuzman et al., 2020). Yet, a critical question remains: are these investments adequately addressing the challenges posed by the global shift toward more integrated and technology-driven supply chains? While Vlahović (2013) positions wholesale markets as intermediaries bridging manufacturers and retailers, the argument lacks nuance, particularly in considering how these markets compete with or complement alternative distribution channels, such as e-commerce platforms.

Globally, wholesale markets are acknowledged as essential commercial and logistical intermediaries in the trade of fruits and vegetables (Kuzman et al., 2018). However, as Boiko et al. (2019) note, their role in food product marketing cannot be isolated from the broader retail ecosystem. This interdependence raises questions about the extent to which wholesale markets can remain competitive in light of shifting consumer preferences and the growing emphasis on sustainability in supply chains.

Historically, markets have existed for millennia, originating with the advent of commodity exchange around 5,000 years ago (Petrović et al., 2021). Despite their historical significance, their evolution into modern entities has been uneven. For example, Ostojić et al. (2013) highlight their traditional focus on fresh and high-quality products, but this focus may no longer be sufficient to sustain their relevance in an era of digital transformation and shifting consumer demands. Modern markets are increasingly organized into urban clusters (Marciniak, 2020), yet their integration with mobile technologies and digital business principles remains nascent. Prdić (2022) underscores the importance of adopting mobile technology to enhance operational efficiency, but the broader literature provides limited empirical evidence on the actual impact of such innovations. Moreover, consumer loyalty to markets in Serbia, traditionally rooted in local and repeat purchases, may erode without proactive measures to adapt to changing market dynamics (Prdić, 2022). The retail sector, as Rosa et al. (2018) observe, is continuously evolving, and the success of agri-food supply chains hinges on the strength of each link (Gazdić et al., 2022). However, existing literature tends to focus on individual links rather than the systemic challenges affecting the entire chain. For instance, while Miletić et al. (2022) emphasize the strategic importance of after-sales assessments, these analyses often neglect the unique complexities of wholesale markets. Similarly, Sekulić et al. (2023) analyze product life cycles through consumer attitudes but fail to address the role of wholesale markets in influencing these attitudes.

Urban development and social welfare regulation, as discussed by Gajić et al. (2024) and Kotler et al. (2008), are critical components of market ecosystems. Yet, the literature rarely connects these macro-level considerations with the operational realities of wholesale markets. Additionally, as Kostić (2022) points out, social media marketing requires distinct strategies to build brand loyalty—an area where wholesale markets remain underexplored.

A notable gap in domestic literature is the lack of empirical studies on the factors influencing the development of green markets through wholesale market strategies. While theoretical explorations exist, they often fail to capture the dynamic interplay between wholesale markets, small markets, producers, and other stakeholders. This paper seeks to address this gap by presenting empirical research that examines these interactions and highlights the potential for wholesale markets to drive rural and agricultural development.

While wholesale markets are often depicted as indispensable to agricultural supply chains, the literature reveals significant gaps in understanding their adaptability, integration with modern technologies, and broader role in sustainable development. By critically analyzing these aspects, this study aims to contribute to a more nuanced understanding of their function and potential in the evolving market landscape.

Materials and methods

This research focuses on analyzing the role of wholesale markets as key supply channels for green markets in Serbia, evaluating their impact on economic efficiency and participant satisfaction within the supply chain. The methodology combines theoretical and empirical approaches to provide a comprehensive and valid understanding of the research problem, with clearly defined criteria for data collection and analysis.

The sample included 30 vendors from the Kvantaška Pijaca market in Novi Sad, of which 15 were fruit vendors and 15 were vegetable vendors. This selection was based on the criterion that participants must have at least five years of sales experience, ensuring they are well-acquainted with market conditions and processes. Additionally, the study involved 20 vendors from other local markets (Futoška, Limanska, Riblja, and Satelitska markets), providing broader insights into the specific characteristics of different sales locations within the same urban context. The decision to limit the sample to 50 respondents stems from practical constraints, such as available research resources and the timeframe for conducting the study. Despite this, carefully defined selection criteria ensured the sample's representativeness for the target group. However, the limited sample size has implications for the external validity of the results, as the findings cannot be fully generalized to the broader population of vendors in Serbia. Future research should include a larger and more geographically diverse sample to increase the reliability of conclusions.

Primary data were collected through structured interviews conducted between March and April 2024. A questionnaire, used as the main research instrument, was designed

to examine key aspects of vendor satisfaction and communication. The questions were formulated using a Likert scale ranging from 1 to 5, where 1 indicated the lowest level of satisfaction or agreement, and 5 indicated the highest level. The questionnaire covered demographic and socio-economic characteristics of the respondents, satisfaction with current sales conditions, the level of awareness about the new wholesale market, and perceptions of future sales opportunities.

The validity of the collected data was ensured through a rigorous research design and the application of appropriate criteria for participant selection. However, moral hazard was identified as a potential risk, as respondents might provide answers that align with their interests rather than reflect actual conditions. To minimize this bias, the interviews were conducted in a controlled environment, with neutral question phrasing and respondent anonymity. Data analysis was performed using descriptive statistics and significance tests to evaluate the research hypotheses. The results were interpreted in the context of sustainable development, economic efficiency, and communication effects, with the aim of providing recommendations for improving wholesale markets and their contribution to rural area development.

This methodology provides a comprehensive approach to the research, offering detailed insights into current challenges and potential opportunities for enhancing wholesale markets as a vital component of the agricultural product market in Serbia.. Research hypotheses were defined from the subject problem.

H1*: Vendors at the Kvantaška Pijaca market are "satisfied" with their sales*

H2*: Vendors at the Kvantaška Pijaca market have a positive attitude about the potential sales opportunities at the Wholesale Market*

H3*: Vendors at small marketplaces are insufficiently informed about the efficiency of purchasing goods at the Wholesale Market*

Results

In data analysis, descriptive statistics (percentages, arithmetic mean, and standard error) were used to describe the sample. There is a significant correlation between groups of questions - categories, which is measured by the correlation coefficient of the relevance and integration of the market communication of the vendors of Kvantaška Pijaca and other small markets. For testing individual hypotheses, the value of all questions related to the individual hypothesis will be used. In the hypothesis H1, the term *"Satisfaction"* refers to the degree of achievement of the economic and communication goals of the vendors at the Kvantaška Pijaca market. Under the term *"Changes in sales"* in the hypothesis H2 is meant the expected value of moving wholesale to the wholesale market. While under the term *"Insufficiently informed"* in the hypothesis H3, it is understood that vendors in small markets are insufficiently informed by the employer and other relevant institutions about the advantages of selling at the Wholesale Market.

Table 1. Demographic characteristics of the respondents

Control variables	Features (number)	Share (percentage)	Cumulative share
Farm owner	20	66.6	66.6
Farm member	6	20.0	86.6
Professional associate	2	6.7	93.3
Employee	2	6.7	100.0

Source: Author's research

15 fruit vendors and 15 vegetable vendors took part in the survey, which was conducted at the Kvantaška Pijaca market within the JKP Tržnica Novi Sad public communal enterprise. The largest number of respondents belongs to the farm owners (66.6%), farm members (20%), while 6.7% of the respondents are persons who are employed elsewhere and earn additional income on the market and professional associates, persons who have advisory role in sales. The condition from the subject of the research is also fulfilled, which is selling for at least 5 years on the market and maintaining a customer database.

Investments in sustainable technology have a significant and strong positive impact on economic development (Gajić et al. 2024). In order for the process to be completed successfully, it is necessary to have a special organizational unit in charge of the budget within the organization (Mihajlović et al., 2022). Considering the structure of the sample and the importance of investments and budgets for the development of the farm, it was observed that the vendors are the responsible members of the family community, who have an overview of most of the business and, therefore, the development strategy and the market position of the farm.

The findings from Table 2 indicate that the gender distribution across the three segments of respondents shows some variation, with males consistently forming the majority in each segment. Specifically, Segment #1 and Segment #2 have a similar male-to-female ratio (68% male and 32% female in Segment #1, and 70% male and 30% female in Segment #2), while Segment #3 demonstrates a slightly more balanced distribution, with 60% male and 40% female respondents. The chi-square test results ($\chi 2(df=2)=4.380$, $p=0.112$) reveal that these differences in gender distribution are not statistically significant at the conventional 0.05 level. This indicates that the observed variations in gender structure across the segments could be attributed to random chance rather than a systematic difference.

While there is a clear male dominance in all segments, the differences in gender composition are not statistically meaningful, suggesting that gender is unlikely to play a distinctive role in shaping responses or behaviors across these groups in the context of this study.

Table 2. Comparison of respondents according to gender structure

	Gender structure of the respondents	
	male	female
Segment #1	68%	32%
Segment #2	70%	30%
Segment #3	60%	40%
	χ^2 (df=2)=4.380 p=0.112>0.,005	

Source: Author's research

The analysis of age and education among respondents reveals distinct patterns, though these differences are not statistically significant (Table 3). Segment #1 exhibits a balanced age distribution, with respondents evenly spread across age categories, while Segment #2 is predominantly composed of younger individuals aged 20–40. In contrast, Segment #3 is characterized by a higher proportion of middle-aged respondents and a notably small percentage of those over 60. Despite these observable trends, the chi-square test results indicate that the variations in age distribution across the segments are not significant ($\chi2(2, n=150)=2.377$, $p=0.307$), suggesting that the differences may be random.

When examining education levels, respondents predominantly possess primary and secondary education across all segments, with higher education being less common and advanced degrees (master's or PhD) even rarer. While the distribution appears to vary slightly, with Segment #1 having a slightly higher representation of individuals with lower education levels, and Segments #2 and #3 showing a modest increase in higher education, these differences are also not statistically significant ($\chi2(2, n=150)=3.794$, $p=0.147$). This implies that educational attainment does not differ systematically between the groups and is unlikely to influence responses or behaviors in a meaningful way within the context of this study.

Table 3. Comparison of respondents according to age and education

	Age of the respondents			The level of education of the respondents		
	20-40	**40,1-60**	**Over 60,1**	**Primary and secondary education**	**higher education**	**master, PhD**
Segment #1	24%	40%	36%	50%	32%	15%
Segment #2	62%	26%	60%	46%	42%	14%
Segment #3	14%	34%	4%	54%	42%	11%
	$c^2(2, n=150)=2.377$ p=0.307>0.05			$c^2(2, n=150)=3.794$ p=0.147>0.05		

Source: Author's research

The presented results, tested using a non-parametric test (Kruskal-Wallis test), indicate that there is no statistically significant difference between the segments (fields) when it comes to the age of the respondents or when looking at the level of education.

The analysis of customer characteristics at the Kvantaška Pijaca market reveals important patterns regarding the type and behavior of customers. Small-scale customers, who predominantly represent individual buyers or smaller business owners, account for a total of 2,150 visits, of which 250 resulted in purchases at the point of sale. Large-scale customers, such as wholesalers and larger businesses, contribute 1,340 total visits, with 240 involving direct purchases. Potential customers, those who visited the market but may or may not have engaged in transactions, represent the largest segment, with 6,120 total visits and 1,020 resulting in purchases. This data highlights that while potential customers constitute the majority of market visitors, their conversion rate into actual buyers is relatively low. Conversely, small-scale and large-scale customers demonstrate higher conversion rates, indicating more consistent purchasing behavior. The total visitor count of 9,610 underlines the significant traffic at the Kvantaška Pijaca market, yet the challenge lies in effectively converting potential customers into active buyers to optimize market performance and sales outcomes. These insights suggest opportunities for targeted marketing strategies and improved communication to better engage potential customers and increase overall market efficiency (Table 4).

Table 4. Characteristics of customers at the Kvantaška Pijaca market

Characteristics of customers	Customers who visited the point of sale	Customers who visited the point of sale (and may or may not have bought products on the market)	Total
Small-scale	250	1900	2150
Large-scale	240	1100	1340
Potential	1020	5100	6120
Total	1510	8100	9610

Source: Results of a survey of vendors' stands; Author's calculation

1. Small-scale customers - purchase value less than €3000€ in the previous year (2023)
2. Large-scale customers - purchase value greater than €3000 in the previous year (2023)
3. Potential customers - they have not bought products at the point of sale

Visitors to a point of sale at the Kvantaška Pijaca market can be existing or potential customers. By communicating at the point of sale, existing customers and their loyalty as well as potential customers can be influenced. Researching the attitudes and perceptions of potential customers, vendors must do direct personal communications and apply live word at the point of sale, but also with other marketing communication instruments in order to influence their purchase intentions. The collected data is part of the sales and communication strategy of the vendors. When it comes to the research hypothesis:

H1: Vendors at the Kvantaška Pijaca market are "satisfied" with their sales

During the interview itself and conversations with fruit and vegetable vendors, the view that the requirement for an interview is to sell products for at least 5 years, is very important. This condition is set for the relevance of the research. The surveyed wholesalers and retailers in response to the question from hypothesis H1 were able to give an answer on a scale from 1 to 5, where 1 expressed the least satisfaction, and 5 extreme satisfaction.

Table 5. Data on the average rating of satisfaction with sales at the Kvantaška Pijaca market (tested value = 2.7)

One-Sample Statistics

	N	Mean	Standard deviation	Standard error of the mean (SEM)
Satisfaction	30	2.5407	0.75089	0.07657

Source: Author's research

Table 6. One sample test, average satisfaction rating (tested value = 2.7). 95% confidence interval for the difference

One-Sample Test

	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Satisfaction	-2.233	29	0.029	-0.16835	-0.3212	-0.0166

Source: Author's research

According to the obtained empirical test data, the significance a*=0.029=2.9%, we got the value a*<5%, indicating that the average value (satisfaction rating) differs from the tested value, which therefore further indicates that the hypothesis that the average satisfaction rating on to the entire Kvantaška Pijaca market is 2.7 cannot be confirmed. The first hypothesis, which states that the vendors at Kvantaška Pijaca are "satisfied" with their sales, is not valid, even though the vendors gave an average rating of 2.54. This conclusion arises from the fact that a satisfaction rating of 2.54 is below the reference threshold that would be considered the benchmark for "satisfaction." For example, in the context of a Likert scale, where a score of 3 or higher is often interpreted as neutral or positive perception, a score below this threshold (such as 2.54) indicates dissatisfaction.

Therefore, while the rating is quantified, it is not high enough to support the claim that the vendors are "satisfied." This conclusion is further supported by empirical tests, which reveal a significant difference between the obtained average value and the expected satisfaction rating of 2.7, further indicating that Hypothesis H1 was not accepted.

Based on the database of wholesalers (vendors) about customer characteristics in Table 7, a survey of vendors was also conducted on the same basis, whether small-scale, large-scale and potential customers from their database would visit their points of sale

at the new Wholesale Market (Table 8). The goal was to determine the impact of the Wholesale Market on the awareness of the visit itself and the visit to the vendor's point of sale and the interest of potential customers in visiting the Wholesale Market and the vendor's point of sale.

Through research, it is necessary to determine the degree of awareness about the new Wholesale Market and the visit to the vendors' point of sale. In this case, it is necessary to apply the Likert ranking scale from 1 to 5, where 1 is low interest (no visit to the Wholesale Market and no purchase intentions), while 5 is a very high interest in visiting the Wholesale Market and the point of sale (high level of interest in the Wholesale Market and high level of purchase intentions).

Table 7. Vendors' plans to sell on the wholesale market

Description	Arithmetic mean	Standard error
Small-scale customers		
Bought at your point of sale and at the market	2.63 (n=90)	0.22
Haven't bought at your point of sale and at the market	2.78 (n=85)	0.19
Large-scale customers		
Bought at your point of sale and at the market	3.24 (n=83)	0.18
Haven't bought at your point of sale and at the market	3.10 (n=80)	0.18
Potential customers		
Bought at your point of sale and at the market	2.38 (n=75)	0.21
Haven't bought at your point of sale and at the market	2.30 (n=70)	0.24

Source: Results of a survey of the Kvantaška Pijaca market vendors' stands; Author's calculation *(*1 = no purchase plans; 5 = very defined purchase plans)

The results of the research on visits to the new Wholesale Market and purchase intentions are shown in Table 7 and Table 8. The data on vendors' plans to sell on the wholesale market, as presented in Table 7, reveals distinct patterns based on customer type and purchasing behavior. For small-scale customers, the arithmetic mean of vendors' plans to sell on the wholesale market is slightly higher (2.78) for those who did not buy at the point of sale or market compared to those who did (2.63). This indicates a marginally stronger inclination to consider the wholesale market among vendors catering to non-buying small-scale customers, although the difference is relatively small. Large-scale customers, representing wholesalers and businesses with higher purchasing power, show the highest overall scores among all customer types. Vendors serving large-scale customers who bought at the point of sale or market report a mean score of 3.24, while those serving non-buying customers report a slightly lower mean of 3.10. These results suggest that vendors perceive significant opportunities for engaging with large-scale customers on the wholesale market, particularly those who are already purchasing.

Potential customers, who form the largest group, show the lowest levels of vendor intent to sell on the wholesale market. The arithmetic mean for those who bought at the point of sale or market is 2.38, while for non-buyers it is even lower at 2.30. This indicates that vendors are less confident in the wholesale market's ability to attract or engage potential customers effectively.

The findings highlight that vendors' plans to sell on the wholesale market are influenced by the type of customer and their purchasing behavior. Large-scale customers appear to be the most promising segment for wholesale market engagement, while potential customers present a challenge in terms of conversion and vendor interest. These insights suggest the need for targeted strategies to enhance vendor confidence and customer engagement, particularly among potential customers, to maximize the wholesale market's success

The cumulative analysis of buyers at the wholesale market highlights significant differences in purchasing behavior across customer segments. Small-scale customers who visited the point of sale had a purchase rate of 7.2% with cumulative sales per customer of 335, compared to 3.3% and 265 for those who did not visit. This indicates that direct interaction at the point of sale positively influences their purchasing decisions and sales value. Large-scale customers showed the highest purchase rates, with 22.7% of those who visited the point of sale making purchases and achieving cumulative sales of 550 per customer. Even among those who did not visit, the purchase rate was 11.9% with cumulative sales of 328, underscoring the strong potential of this segment. Potential customers exhibited the lowest engagement, with only 2.0% making purchases when visiting the point of sale and cumulative sales of 250. For those who did not visit, the purchase rate dropped to 0.6%, with cumulative sales at 176. This highlights a significant challenge in converting potential customers into active buyers (Table 8).

Table 8. Cumulative analysis of buyers for purchases at the Wholesale Market

Description	Number of customers	Sales as a percentage of the number of customers (%)	Cumulative sales per customer
Small-scale customers, visited the point of sale (n = 250)	19	7.2	335
Small-scale customers, haven't visited the point of sale (n = 1700)	63	3.3	265
Large-scale customers, visited the point of sale (n = 200)	46	22.7	550
Large-scale customers, haven't visited the point of sale (n = 1020)	120	11.9	328
Potential customers, visited the point of sale (n =1010)	20	2.0	250
Potential customers, haven't visited the point of sale (n =10200)	74	0.6	176

Source: Results of a survey of the Kvantaška Pijaca market vendors' stands; Author's calculation

It should be noted that the planned relocation period is March or April, which is favourable for continued work, both due to the sales range and weather conditions. However, based on the communication findings during the survey of vendors, the author's experience as well as the proposal for the location of the Wholesale Market (the area of the current Najlon Pijaca market), the vendors expect real economic effects already at the beginning of September. The communication effects were achieved at the Kvantaška Pijaca market itself, they are very significant due to the already existing knowledge of the customers about the quality, price and freshness of the products.

Analyzing the economic effects based on the cumulative analysis of sales at the wholesale market (Table 8), it is possible to calculate the rate of return on the investment by renting a sales place at the Wholesale Market. The overall economic effect of leasing space at the Wholesale Market, viewed from the point of view of purchase plans, is obtained by multiplying the value of the realized sales by the observed customer categories with the average gross profit rate. The short-term rate of return on the investment in percentages represents the lower limit of the value of a new point of sale at Wholesale Market in terms of short-term sales. In the long term, communication effects are achieved through advertising, digital marketing, sales promotion and word of mouth. If we assume that the vendors will continue to maintain a database of customers, it is possible to determine the economic and communication effects of selling on the Market for a longer period of time. Therefore, based on the database of customers and realized sales, it is possible to calculate income as a function of time in a certain observed period after relocation. When it comes to the research hypothesis:

H2: Vendors at the Kvantaška Pijaca market have a positive attitude about the potential sales opportunities at the Wholesale Market

According to the empirical significance data obtained, a*=0.946==94.6% a*>5, which means that the average value (score of positive expectations of wholesalers) does not differ from the tested value, which indicates that the hypothesis H2 ***can*** be accepted, that the average score of expectations on sale is 4 at the new Wholesale Market in the entire set (Table 9 and 10).

Table 9. Data on average score of positive change in sales (tested value = 4**)**

One-Sample Statistics

	N	Mean	Standard deviation	Standard error of the mean (SEM)
Change in sales	30	3.98847	.63771	.06411

Source: Author's research

Table 10. One sample test, average score of positive sales expectations (tight value=4). 95% Confidence Interval of the Difference

One-Sample Test

	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Change in sales	-.078	29	.946	.00504	-.1332	.1232

Source: Author's research

Data from the survey of vendors at the Futoška Pijaca, Limanska Pijaca, Riblja Pijaca and Satelitska Pijaca markets are shown in Table 11. The research was conducted on a sample of 5 fruit vendors and 5 vegetable vendors in each individual market. Respondents had the opportunity to rate their opinion on various statements from the research questions satisfaction/insufficient communication/consumer behavior from 1 to 5, where 1 indicated a strongly negative opinion, and 5 a strongly positive one. According to the data in table 11, the score of "satisfaction" variable with the place of purchase of goods of market vendors who sell at the "Futoška Pijaca" market is 2.4280, of those who sell at the "Limanska Pijaca" market it is 2.6280, of those who sell at the "Riblja Pijaca" market is 2.4456 and on the "Satelitska Pijaca" market it is 2.8112. The average score of respondents' satisfaction in the area of all markets is 2.5205. The estimated score of "insufficient communication" on "Futoška Pijaca" market is 4.4270, on "Limanska market" - 4.2270, on "Riblja Pijaca" market - 4.3476, on "Satelitska Pijaca" - 4.0132. The average rating of insufficient communication in the area of all markets from the research is 4.2204. The average rating of "consumer behavior" on the "Futoška Pijaca" market is 4.1280, on the "Limanska Pijaca" market 4.0780, on the "Riblja Pijaca" market it is 3.9856, on the "Satelitska Pijaca" market - 4.2102. The average rating of consumer behavior in all small markets from the survey is 3.8945. Throughout history, markets have had their users and have continuously adapted to their needs (Prdić, 2023). When it comes to the research hypothesis:

H3: Vendors at small marketplaces are insufficiently informed about the efficiency of purchasing goods at the Wholesale Market

Table 11. Data on the average rating of satisfaction/insufficient communication/consumer behavior, by the place of purchase of the vendors' goods according to the location of the market (headquarters of the market)

The market where the customers shop	Satisfaction	Insufficient communication	Consumer behaviour
Futoška Pijaca -			
Mean	2.4280	4.4270	4.1280
N	125	125	125
Std. Deviation	.73350	.73340	.63350
Median	2.4215	4.5213	4.1215
Limanska Pijaca -			
Mean	2.6280	4.2270	4.0780
N	125	125	125
Std. Devitaion	.71043	.67033	.71043
Median	2.6657	4.3677	5.6677
Riblja Pijaca - Mean	2.4456	4.3476	3.9856
N	125	125	125
Std. Devitaion	.73251	.63251	.83251
Median	2.4135	4.5435	4.0235
Satelitska Pijaca -	2.8112	4.0132	4.2102
Mean	125	125	125
N	.90124	.65134	.60134
Std. Devitaion	2.6675	4.1175	4.0000
Median			
	2.5205	4.2204	3.8945
Total - Mean	500	500	500
N	.76085	.66035	.66285
Std. Devitaion	2.5000	4.5000	4.1157
Median			

Source: Author's research

The analysis of the average rating for being informed provides insights into respondents' perceptions of their level of information. Table 12 shows that the mean rating for "insufficiently informed" is 4.1332, slightly above the tested value of 4, with a standard deviation of 0.66261 and a standard error of the mean (SEM) of 0.06647. This indicates a relatively consistent response among the participants. Table 13 presents the results of a one-sample t-test, comparing the average rating to the tested value of 4. The t-value of 1.837, with 39 degrees of freedom (df), yields a p-value of 0.066, which is above the conventional significance threshold of 0.05. This suggests that the difference between the mean rating (4.1332) and the tested value (4) is not statistically significant. The 95% confidence interval for the mean difference ranges from -0.0090 to 0.2545, further indicating that the observed difference is negligible.

While respondents rated their level of being informed slightly above the tested value, the lack of statistical significance implies that their perception does not strongly deviate from the neutral benchmark. This suggests that the respondents generally feel

moderately informed, but there may still be room for improving communication and information dissemination.

Table 12. Data on the average rating of being informed (tested value = 4)

One-Sample Stastistics

	N	Mean	Standard deviation	Standard error of the mean (SEM)
Insufficiently informed	40	4.1332	0.66261	0.06647

Source: Author's research

Table 13. One sample test, average rating of being informed (tested value =4). 95% Confidence interval of the Difference

	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Insufficiently informed	1,837	39	0.066	0.12233	-0.0090	-0.2545

Source: Author's research

The analysis of the correlation between different aspects of market communication integration among vendors at Kvantaška Pijaca and other small markets highlights a strong interconnectedness between key variables, as shown in Table 14**.** Sales organization emerges as a central factor, showing significant positive correlations with interactivity ($r = 0.558$, $p < 0.001$, $r = 0.558$, $p < 0.001$, $r = 0.558$, $p < 0.001$), marketing ($r = 0.562$, $p < 0.001$, $r = 0.562$, $p < 0.001$, $r = 0.562$, $p < 0.001$), strategic vision ($r = 0.528$, $p < 0.001$, $r = 0.528$, $p < 0.001$, $r = 0.528$, $p < 0.001$), and sales planning ($r = 0.677$, $p < 0.001$, $r = 0.677$, $p < 0.001$, $r = 0.677$, $p < 0.001$). This indicates that well-structured sales processes are foundational for effective market communication and coordination. Interactivity also plays a critical role, correlating significantly with marketing ($r = 0.567$, $p < 0.001$, $r = 0.567$, $p < 0.001$, $r = 0.567$, $p < 0.001$) and strategic vision ($r = 0.503$, $p < 0.001$, $r = 0.503$, $p < 0.001$, $r = 0.503$, $p < 0.001$), suggesting that active engagement among vendors is essential for aligning marketing strategies with broader operational goals. Similarly, marketing demonstrates strong relationships with strategic vision ($r = 0.640$, $p < 0.001$, $r = 0.640$, $p < 0.001$, $r = 0.640$, $p < 0.001$) and sales planning ($r = 0.531$, $p < 0.001$, $r = 0.531$, $p < 0.001$, $r = 0.531$, $p < 0.001$), highlighting its importance in connecting daily activities with long-term objectives. Strategic vision is strongly correlated with sales planning ($r = 0.621$, $p < 0.001$, $r = 0.621$, $p < 0.001$, $r = 0.621$, $p < 0.001$), reflecting that having a clear strategic framework supports effective and coordinated sales efforts. Together, these findings illustrate that the integration of market communication fosters collaboration and alignment among vendors, enabling them to achieve both short-term and long-term objectives. Overall, the results from Table 14 suggest that vendors who prioritize interconnected processes, such as organization, interactivity, and strategic planning, are better positioned to enhance their market competitiveness and operational efficiency. A cohesive communication strategy is essential for achieving sustainable growth in market operations.

Table 14. Correlation coefficient and degree of relevance between the degree of integration of market communication of vendors of Kvantaška Pijaca and other small markets

	Sales organisation	Interactivity	Marketing	Strategic vision	Sales planning
Sales organisation N	1.000 60	.558** .000 60	.562** .000 60	.528** .000 60	.677** .000 60
Interactivity N	**	1.000 60	.558** .000 60	.567** .000 60	.503** .000 60
Marketing N	**	**	1.000 60	.640** .000 60	.531** .000 60
Strategic vision N	**	**	**	1.000 60	.621** .000 60
Sales planning N	**	**	**	**	1.000 60

Source: Results of a survey of the Kvantaška Pijaca market vendors' stands; Author's calculation *(N = Correlation coefficient and degree of relevance; ** The correlation is relevant at the 0.01 level of relevance (mutual*).

The categories that determine the integration (Table 14) of Kvantaška Pijaca market and other small markets are:

- **Sales organization** (mutual cooperation in sales, knowledge of communication tools, existence of a personal database, cooperation with market management)
- **Interactivity** (coherence of communication with sales, maintaining a customer database)
- **Marketing** (vision and communication plan, analysis of the market environment, cooperation plan with customers and consumers through the loyalty program)
- **Strategic vision** (harmonizing the communication strategy with the market position on the market, optimal integration of marketing communication and digital marketing instruments, vision (benchmarking) analysis with sales trade chains)
- **Sales planning** (SWOT analysis as a part of sales and communication, sales planning considering the historical importance of markets, planning the "brand" of markets and organizing economic events at markets, studying relations with customers and consumers, exploiting the traditional, social and public role of markets, using living words in sales promotion with customers and consumers).

After reviewing the theoretical and empirical research results, the author's experience, we must state that the operationalization of an integrated model from the perspective of all participants in the sale of fruits and vegetables is an open topic for the future. The whole process of operationalizing the success of trade at the Wholesale Market and small markets needs to be constantly checked with new variables. For our conceptual model at the operational level, topics are open for new empirical investigations and competitive comparisons.

The purpose of benchmarking in the example of markets is the desire to implement a marketing strategy of innovation and positioning by learning from more capable competitors by applying more intelligent solutions to exploit old positions (Prdić, 2022). So, here is a plea for the necessity of organizing dynamic business analyses (Durkalić et al., 2019; Čavlin, 2022). A practical example is shown in Table 15.

Table 15. Benchmarking indicators for markets

Criterion	Indicator
Growing demand for business space and stalls	Growth rate and level of income
Utilisation of renting space	Utilization rate
Competitiveness	Market share of retail markets
Seasonal sales of products	Coefficient of sales in the markets
Marketing	The share of marketing in the business result
Tradition and importance of markets for tourism	The share of tourism and other development factors

Source: Prdić, 2022

On the basis of the theoretical conceptual model, which we presented and confirmed in this research, a more advanced structural model can be built on, which can have the presented model as its starting point. Model checking can be confirmed by other statistical methods. The purpose of upgrading the model in the sale of fruit and vegetables has its origin in better sales results with the final outcome of a satisfied customer. This research also has certain limitations. The limitation can be placed in the context of the sample size, i.e. markets in other parts of the Republic of Serbia are not included, although the choice to research markets in Novi Sad is good for illustrating the basic set. Therefore, among further research, there could be a recommendation to conduct a new research on a larger or whole group so that the results are more representative. Namely, repeated research, during future research over time, can contribute to the coexistence and greater reliability of the results.

Discussion

The findings of this study align with and expand upon existing research on the role of distribution channels and wholesale markets in agricultural supply chains. Biot et al. (2024) highlight the importance of efficient distribution channels for the viability of market gardening farms, emphasizing their role in connecting rural production with urban demand. Our study confirms this by demonstrating that wholesale markets, such as Kvantaška Pijaca, serve as critical hubs for facilitating these connections. Vendors

who are actively engaged in organized sales and strategic planning reported higher satisfaction, mirroring the significance of well-integrated supply chains as identified in Biot et al.'s research (2024).

Similarly, the sustainable development of rural-to-urban food supply chains, as discussed by Hoang et al. (2024), underscores the importance of addressing logistical and informational challenges. Our findings reveal that vendors at small markets often lack sufficient information about the benefits of wholesale markets, which aligns with Hoang et al.'s emphasis on the need for improved communication strategies to strengthen supply chains in developing contexts. This suggests that targeted informational campaigns could bridge these gaps and enhance market efficiency. Kociszewski et al. (2024) focus on the relationship between farmers and distributors in the organic food market, highlighting trust and collaboration as essential for success. Our study builds on this by illustrating that vendors' satisfaction and economic outcomes are closely linked to their ability to establish reliable partnerships within the wholesale market. However, while Kociszewski et al. (2024) emphasize the role of product quality, our findings suggest that the success of wholesale markets also depends on strategic investments in technology and infrastructure, as highlighted by Wang (2024) in his study of supply chain modernization in China.

The "Farm to Table" concept explored by Omar et al. (2024) is reflected in our findings on the wholesale market's role in bridging rural production with urban consumption. Both studies emphasize the importance of efficient channels for ensuring fresh and high-quality produce reaches urban markets. However, while Ahmad et al. (2024) focus on urban farming dynamics, our study contributes by analyzing the broader impact of wholesale markets on rural economies, showcasing their potential to drive rural development and economic sustainability.

Reardon et al. (2024) describe the role of small and medium enterprises (SMEs) in driving domestic supply chain growth in Africa. Our findings resonate with this, as wholesale markets in Serbia similarly act as nodes for economic development, fostering collaboration among vendors and improving market access. Additionally, the local multiplier effects of short food supply chains, as analyzed by Kłoczko-Gajewska et al. (2024), are evident in our study, which highlights the socio-economic benefits of wholesale markets in supporting local producers and enhancing rural livelihoods.

While Marín et al. (2024) explore agro-food supply chains in peril-urban areas and their role in preserving biodiversity, our study complements this by emphasizing sustainable practices within wholesale markets. Although biodiversity was not a primary focus, the promotion of local and seasonal produce in wholesale markets indirectly supports environmental conservation efforts.

Our findings largely align with the broader body of literature while also addressing specific gaps by providing empirical insights from the context of Serbia. This study highlights the pivotal role of wholesale markets in fostering sustainable agricultural supply chains, emphasizing the need for improved communication, strategic planning,

and technological integration to enhance their effectiveness. Future research should explore additional dimensions, such as environmental impacts and the role of policy interventions, to further strengthen the understanding of wholesale markets as drivers of rural and urban development.

Conclusion

Wholesale markets represent priority distribution channels for sustainable agriculture and other sectors of rural production, functioning as a key source of vitality for agricultural communities. Innovations in production and distribution are essential for survival and form the foundation of market competitiveness. The distribution of agricultural products (fruits and vegetables) through wholesale markets provides a long-term advantage over competitors, enabled by the introduction of new or improved products and customer-oriented services (Kociszewski et al., 2024).

This study analyzes the role of wholesale markets as supply channels for green markets and their impact on sustainable rural development. The findings show that wholesale markets, such as Kvantaška Pijaca, not only improve the efficiency of distribution channels but also strengthen the socio-economic link between rural producers and urban consumers. Key challenges were identified in communication between vendors and relevant institutions, as well as in the limited awareness of vendors regarding the advantages of modern wholesale markets. At the same time, the results highlight significant potential for improvement through innovative strategies, including digital transformation and strengthened supply chain partnerships.

Theoretical and practical implications

The original contribution of this study lies in integrating empirical data from Serbia into the broader global understanding of distribution channels and sustainable development. It provides new insights into the role of wholesale markets as crucial intermediaries between rural and urban markets, emphasizing their importance in socio-economic development and sustainability. The study contributes to theory by highlighting the interdependence of communication strategies, sales organization, and strategic planning, which can serve as a foundation for future research models.

It advances existing global knowledge by offering empirical evidence on the effects of wholesale markets in post-socialist economies, opening new avenues for research in similar regions. This study is relevant for policymakers in agriculture and trade, researchers, and industry practitioners. Policymakers can use the findings to improve strategies for rural development and modern wholesale market construction. Researchers will find valuable data for comparison with other regions, while managers and institutions can benefit from the recommendations for strengthening communication and organization within the supply chain. It is particularly significant for the agricultural trade industry, as it highlights ways to combine sustainability and economic efficiency effectively.

Limitations and directions for future research

A limitation of this study is its focus on a single region, which restricts the generalizability of the findings on a global scale. The sample size was also limited, potentially affecting the statistical power and interpretation of results. Additionally, the research did not address specific ecological impacts of wholesale markets, presenting an opportunity for future studies.

Future research should include larger samples and geographically diverse regions to ensure broader applicability of the results. Special attention should be given to the digitalization of wholesale markets, their impact on local biodiversity, and the role of policies in strengthening rural-urban linkages. Studies in other industries, such as the food or transport industries, could use this study's methodology to analyze supply chains. This study provides a unique empirical contribution by analyzing wholesale markets in Serbia, an underexplored topic in the international context. New insights include understanding the interdependence of communication strategies and economic efficiency, as well as identifying key obstacles to improving wholesale markets. The methodology is justified as it integrates qualitative and quantitative approaches, enabling an in-depth analysis of a specific market context. The results are clearly presented and accessible, not only to the academic community but also to industry practitioners.

This study is significant for researchers studying distribution channels, policymakers focusing on rural development, and educators seeking to provide their students with examples of research with direct practical implications. Its impact on academic research lies in enhancing the understanding of the socio-economic aspects of wholesale markets, while the industry benefits from specific recommendations for improving communication and operational efficiency. This research represents a valuable resource for anyone seeking to understand the role of wholesale markets in modern agricultural and economic systems

Acknowledgments

This research was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Contract No. 451-03-66/2024-03/200172).

Conflict of interests

The authors declare no conflict of interest.

References

1. Biot, N., Hecquet, C., Maréchal, K., Lobet, G., & Dendoncker, N. (2024). The importance of distribution channels and food supply chain challenges on the viability of market gardening farms: Insights from market gardeners in Belgium at a territorial level. *HAL Archives Ouvertes*. Retrieved from https://hal.science/hal-04594127

2. Boiko, V., Kwilinski, A., Misiuk, M., & Boiko, L. (2019). Competitive advantages of wholesale markets of agricultural products as a type of entrepreneurial activity: The experience of Ukraine and Poland. *Economic Annals-XXI, 175*(1-2), 68–72. https://doi.org/10.21003/ea.V175-12

3. Cvijanović, D., Ignjatijević, S., Tankosić, V J., Cvijanović, V. (2020). Do Local Food Products Contribute to Sustainable Economic, *Sustainability,* 12 (7), 2847; https://doi.org/10.3390/su12072847

4. Čavlin, M. (2022). Modern approach and settings of the concept of comprehensive business analysis. *Economist, 1*(1), 29–42. https://doi.org/10.46793/EKONOMIST1.1.3

5. Gajić, T., Đoković, F., Vukolić, D., & Bugarčić, J. (2024). The role of zero waste principle in enhancing economic development in the hotel business. *Economist, 1*(3), 23–45. https://doi.org/10.46793/EKONOMIST3.1.2G

6. Gajić, T., Bugarčić, J., & Cvijanović, D. (2024). Balancing act: Gastrotourism as a catalyst for urbanization and the imperative for green investments in the Republic of Serbia. *Tourism International Scientific Conference Vrnjačka Banja - TISC, 8*(1), 460–470. https://doi.org/10.52370/TISC24460TG

7. Gazdić, D., & Nađ, D. (2022). Supply chain analysis in agribusiness to improve competitiveness. *Economist, 2*(1), 35–46. https://doi.org/10.46793/Ekonomist1.2.4

8. Durkalić, D., Furtula, S., Borisavljević, K. (2019), Ranking tourism market perfomance in EMU countries: results of PROMETHEE - GAIA approach, *Hotel and Tourism Management*, 7(2), 67-76, doi: 10.5937/menhottur1902067D

9. Hoang, T., Bell, J., Hiep, P. H., & Autry, C. W. (2024). The sustainable development of rural-to-urban food supply chains in developing nations. *The International Journal of Logistics Management, 35*(1), 158–186. https://doi.org/10.1108/IJLM-02-2022-0072

10. Inayah, S., Sensuse, D., & Lusa, S. (2024). Analysis of factors that influence the acceptance of using online retail applications: A case study of XYZ wholesale and retail stores. *Journal SIOSFOKOM, 13*(1), 145–153. https://doi.org/10.32736/sisfokom.v13il.2051

11. Jeločnik, M., Subić, J., & Zdravković, A. (2022). Economic effects of investment in irrigation at the small family farms. *Economics of Agriculture, 68*(3), 793–817. https://doi.org/10.5937/ekoPolj2203793J

12. Kłoczko-Gajewska, A., Malak-Rawlikowska, A., Majewski, E., Wilkinson, A., Gorton, M., Tocco, B., ... & Veneziani, M. (2024). What are the economic impacts of short food supply chains? A local multiplier effect (LM3) evaluation. *European Urban and Regional Studies, 31*(3), 281–301. https://doi.org/10.1177/09697764231201572

13. Kostić, S. (2022). Research of the influence of social media marketing on consumer brand loyalty in the Republic of Serbia. *Economist, 1*(1), 55–64. https://doi.org/10.46793/EKONOMIST1.1.5

14. Kotler, P., & Li, N. (2008). *Marketing in the Public Sector.* Mate, Belgrade.
15. Kociszewski, K., Krupowicz, J., Graczyk, A., Sobocińska, M., & Mazurek-Łopacińska, K. (2024). The supply-side of the organic food market in the light of relations between farmers and distributors. *Ekonomia i Środowisko, 88*(8). http://dx.doi.org/10.34659/eis.2024.88.1.698
16. Kuzman, B., & Prdić, N. (2018). Strategic significance of wholesale markets in agricultural products sale. *Sustainable Agriculture and Rural Development in Terms of the Republic of Serbia Strategic Goals Realization within the Danube Region,* 87–104. Institute of Agricultural Economics. https://www.iep.bg.ac.rs/sr/naucni-skupovi/iep-konferencija/iep-2018
17. Kuzman, B., & Prdić, N. (2020). Specialized market institutions in the function of agriculture development. *Economics of Agriculture, Sustainable Agriculture and Rural Development in Terms of the Republic of Serbia Strategic Goals Realization within the Danube Region,* 131–146. Available online: https://www.academia.edu/96181493/Specialized_Market_Institutions_in_the_Function_of_Agriculture_Development
18. Kuzman, B., Prdić, N., & Dobraš, Z. (2017). The importance of wholesale markets for trade in agricultural products. *Ekonomika Poljoprivrede, 64*(3), 1177–1190. https://doi.org/10.5937/ekoPolj1703177K
19. Marciniak, L. (2020). The social organization of merchants' activities: An interactionist study of urban marketplaces. *Qualitative Sociology Review, 16,* 106–121. https://doi.org/10.18778/1733-8077.16.4.07
20. Marín, J., Garnatje, T., & Vallès, J. (2024). Agro-food supply chains in peri-urban agricultural areas: Do they contribute to preserving local biodiversity? The case of Baix Llobregat Agrarian Park. *Sustainability, 16*(7), 2882. https://doi.org/10.3390/su16072882
21. Mihajlović, M., & Savić, A. (2022). The role of the budget in financing the defense system of the Republic of Serbia. *Economist, 1*(1), 16–28. https://doi.org/10.46793/EKONOMIST1.1.2
22. Milojević, I., & Mihajlović, M. (2020). Accounting treatment of state benefits and state aid disclosure. *Culture of Polis, 42,* 919–630. https://kpolisa.com/index.php/kp/article/view/198
23. Miletić, V., Grubor, A., & Ćurčić, N. (2022). Post-sales services—a significant performance of organizations' competitive advantage. *Ekonomika,* 43–53. https://doi.org/10.5937/ekonomika2202043M
24. Omar, N. R. N., Ahmad, A. A., Yusoff, M. M., & Ahmad, M. A. (n.d.). From Farm to Table concept: The profile and dynamics of urban farming on agrofood supply chain in Malaysia. Available online: http://www.jfas.info

25. Ostojić, A., Drinić, LJ., Mirjanić, S., Vaško, Ž., Roković, G., Mrdalj, V., & Figurek, A. (2013). Turnover of agricultural products on green and livestock markets in the Republic of Srpska. *Agroznanje, 14*(4), 523–533.

26. Pantović, D., Cvijanović, D., Cvijanović, G., Šobić, Lj. (2023). Tradition and culture as the base for the tourism product: case of UNESCO intangible heritage, *Facta universitatis, Series: Economics and Organization*. 20(2). 103 – 116, [M52=1,25], doi: https://doi.org/10.22190/FUEO230130007P

27. Petrović, M. D., Ledesma, E., Morales, A., Radovanović, M. M., & Denda, S. (2021). The analysis of local marketplace business on the selected urban case—problems and perspectives. *Sustainability, 13,* 3446. https://doi.org/10.3390/su13063446

28. Prdić, N. (2016). Competitive advantage of the wholesale market as a distribution channel. *Agroeconomica, 45*(72), 51–63. http://dx.doi.org/10.5937/ekoPolj1703177K

29. Prdić, N., & Barjaktarević, M. (2019). Economic efficiency of trade on wholesale markets. *Sustainable Agriculture and Rural Development in Terms of the Republic of Serbia Strategic Goals Realization within the Danube Region,* 589–604. Institute of Agricultural Economics. Available online: Economic efficiency of trade on wholesale markets

30. Prdić, N., & Prdić, I. (2022). Mobile devices in the function of the sales at the marketplace. *Economist, 1*(1), 7–15. https://doi.org/10.46793/EKONOMIST1.1.1

31. Prdić, N. (2022). Digitization and fiscalization of marketplaces in the Republic of Serbia. *Economist, 2*(1), 1–12. https://doi.org/10.46793/EKONOMIST1.2.1

32. Prdić, N., & Prdić, I. (2022). Benchmarking analysis of marketplace operations in the Republic of Serbia. *Economist, 2*(1), 47–56. https://doi.org/10.46793/EKONOMIST1.2.5

33. Prdić, N. (2023). Organized events in marketplace promotion. *Economist, 1*(2), 25–34. https://doi.org/10.46793/EKONOMIST2.1.3

34. Reardon, T., Liverpool-Tasie, L. S. O., Belton, B., Dolislager, M., Minten, B., Popkin, B., & Vos, R. (2024). African domestic supply booms in value chains of fruits, vegetables, and animal products fueled by spontaneous clusters of SMEs. *Applied Economic Perspectives and Policy, 46*(2), 390–413. http://dx.doi.org/10.1002/aepp.13436

35. Rosa, A., Iisnawati, I., & Daud, I. (2018). Key factors analysis of e-commerce and marketplace purchasing decisions in Palembang. *Sriwijaya International Journal of Dynamic Economics and Business, 2*(4), 347–364. https://doi.org/10.9259/sijdeb.v2i4.347-364

36. Rustom, G., Hwa Seok, H., & Dong Hyun, S. (2020). A comparative study of agricultural products wholesale markets in the Philippines and South Korea for future development planning. *Journal of International Development Cooperation, 15*(2), 113–139. https://doi.org/10.34225/jidc.2020.15.2.113

37. Sekulić, D., Sekulić, M. N., & Dašić, G. (2023). The importance of the European Green Plan for consumers in the Western Balkans. *Ecologica, 30*(112), 625–631. https://doi.org/10.18485/ecologica.2023.30.112.16

38. Vlahović, B. (2013). *Market of Agricultural Products.* University of Novi Sad, Faculty of Agriculture.

39. Food and Agriculture Organization of the United Nations. (2018). *FAO's work on agricultural innovation: Sowing the seeds of transformation to achieve the SDGs.* Rome, Italy. Available online: The State of Food and Agriculture 2018 | Agrifood Economics | Food and Agriculture Organization of the United Nations

40. Wang, S. (2024). Study on the supply chain channels of agricultural products in Guangzhou for building the Guangdong-Hong Kong-Macao Greater Bay Area under the rural revitalization strategy. *Agricultural & Forestry Economics and Management, 7*(1), 22–27. http://dx.doi.org/10.23977/agrfem.2024.070104

41. World Union of Wholesale Markets WUWM. (2022). *Annual Report 2021*. https://wuwm.org/wp-content/uploads/2022/01/220127_ANNUAL-REPORT_2021.pdf

CORPORATE BRAND IN AGRICULTURE WITH RESPECT FOR THE LIMITING FACTS OF MARKETING APPLICATION IN THE EXAMPLE OF THE REPUBLIC OF SERBIA

Milica Grujić[1]

**Corresponding author E-mail: milicagrujic991@gmail.com*

ARTICLE INFO

Original Article

Received: *31 October 2024*

Accepted: *29 November 2024*

doi:10.59267/ekoPolj250189G

UDC 003.65:658.8(497.11)

Keywords:

Corporate brand, agriculture, marketing, state policies.

***JEL**: Q14, Q28, G21*

ABSTRACT

Corporate branding in agriculture is becoming increasingly important. The growth of conscious consumption in agriculture is accompanied by consumer decisions to base their purchasing decisions on the acquired knowledge about the brand. The authors focused on revealing the influence of selected limiting factors, namely: fragmentation of plots, excessive supply of agricultural products, state policy, characteristics of agricultural products, their separation from consumers, as well as their overall assessment based on the application of marketing on the example of Serbia. We found that there are statistically significant differences in application of the listed factors in relation to partial and majority application of corporate brand on this basis. In addition, we determined that a model of behavior can be predicted in the case of partial application of the corporate brand, and in the case of majority application of corporate brand, such a prediction would be even stronger.

Introduction

Corporate finance in all activities, and therefore also within the framework of agricultural operations in a country, should be seen as an important part of the overall progress of economic operations in a country.

All this is observed both in the field of agricultural financial operations and within the framework of observing all other activities that appear as developmental economic activities, i.e. activities that at a certain moment are viewed as essential for an economy (Castro & Sáiz, 2019).

Corporate business in one economy is not a model of business management of the economy set once and for all, but at a certain moment the model of the overall economy in one economy is set, and therefore within the framework of concrete corporate management, which is of great importance for corporate management in agriculture (Biddiscombe, 2019).

1 Milica Grujić, PhD Candidate, University of Belgrade Faculty of Organizational Sciences, Jove Ilica 154 , 11000, Belgrade, Serbia, Phone: +381 (11) 3950 800, E-mail: milicagrujic991@gmail.com, ORCID ID (https://orcid.org/009-000-8162-1340)

Modern corporate governance in numerous legal entities, such as especially performance measurement in small and medium-sized enterprises, largely depends on the influence of numerous factors such as the intensity of research and development, human capital, patents and brand value, all of which should be taken into account from the aspect of the overall effect of corporate governance as in agriculture as well as in other activities (Dobryagina, 2020).

In addition to the above, the impact of corporate diversification and vertical integration is increasingly important both in developing countries and in a large number of transition countries, which must be taken into account in all economies such as the so-called of the Western Balkans, and therefore within the framework of economic activities in the Republic of Serbia (Gordeev, 2020).

Marketing activities are present both in the field of production from the agrarian domain, and they can also be seen continuously as a continuation of marketing activities in the processing of agricultural production, i.e. within the production of primarily food (Alavion et al., 2016; Hunt, 2017; Yang et al., 2017).

The classical acceptance of marketing in the field of agriculture has continuously changed towards the connection and application of new technological solutions, such as the strong application of IT, digital platforms, etc., with the help of which the practical application of marketing efforts could be facilitated in order to achieve better overall effects in legal entities that have introduced such principles (Brock, 2021; Huang & Chen, 2021; Cook et al., 2021; Gelgile & Shukla, 2023; Nyagango et al., 2023; Giri & Chaulagai, 2024).

Thus, marketing observations and activities related to the application of new technological solutions have achieved numerous effects on business in agriculture and food processing in many economies (Skogstad, 2020; Nasr Ahmed et al., 2020; Pircher et al., 2022; Kamin et al., 2022; Liu et al., 2023; Kazungu, 2024).

Marketing processes lead to structural changes in many activities, and therefore also within agriculture itself, they should be respected and observed especially through the prism of achieving positive effects in agriculture, starting from the application at small agricultural producers all the way to large corporations that have included agricultural production in the chain of their economic activities (Ferdous et al., 2020; Weber et al., 202; Mazumder & Kabir, 2022; Su et al., 2022; El Chami et al., 2022; Siankwilimba et al., 2023; Rossi & Woods, 2024).

Acceptance of marketing is of great importance, especially in the conditions of the existence of non-standard production activities in agriculture, such as, for example, organizing production in the field of sustainable agriculture, organic agriculture, etc. (Gomiero, et al., 2011; Yaseen & Ahmad, 2019; Tamtomo, 2021; Khalil & Villace, 2021; Masikati et al., 2021; Hackley, 2022; Strauss et al., 2022).

Marketing strategies include a broader application approach such as consumer behavior and especially marketing analytics in all fields of observation of the organization of

production, especially in the field of agriculture (Ali et al., 2020; Bocher et al., 2020; Sheth, 2021; van Antwerpen et al., 2021; Gebre et al., 2021; Ligaraba et al., 2023; van der Merwe, 2024).

Market effects that can influence the development of numerous economic branches can very often be measured by the development of marketing, the application of instruments and measures of impact on business, which has a huge impact on the development of agriculture, with the note that it is important to consider the effects of such activities (Amsden & McEntee, 2011; Swanepoel et al., 2022; Angioloni et al., 2024).

Integrative processes in agriculture should inevitably be viewed through forms of improving overall socio-economic and production relations. In such an observation and the activities that arise on that basis, marketing and its forms of exerting influence with respect to the corporate activities of numerous companies increasingly come to the fore (Mishra et al., 2021; Trejo-Pech & Thach, 2021; Aya Pastrana et al., 2022; Abeysiriwardana et al., 2022; Kaki et al., 2024; Shruthi Priya, 2024).

Materials and methods

The work was done in such a way that the observation of the corporate brand was carried out with the application of two forms, namely the partially applied brand and the majority applied brand in the business of legal entities whose focus is agricultural production, regardless of their size, ownership structure, with the condition that they predominantly operated on the territory of the Republic of Serbia.

The main reason for the author's determination to include primary corporate observation in the focus of this study lies in the fact that companies that treat the brand positively apply a strong appreciation of competition in the market where the activities of the mentioned companies are encountered. In addition, there were real reasons for the application of fair identification of consumers with the already adopted brand of the company, but also of other primarily competitive companies on the given market, then respecting the so-called human capital, but also hard-to-measure factors such as consumer awareness, application of innovations, etc. Another important reason was the study of possible factors that could affect the limited application of marketing, namely: the application of state policy primarily to agriculture, the fragmentation of holdings, the excessive supply of agricultural products, the essential characteristics of agricultural products, the separation of products from consumers and their overall evaluation score.

The research period was from August 1 to August 31. 2021 ending with 2024 and included legal entities from the territory of the Republic of Serbia. In total, the survey covered 210 such legal entities, of which corporate brand operations were partially applied to 137 such legal entities, and mostly to 73 such entities. The corporate brand included the following application factors: strength of market competitiveness, international brand valuation, corporate identity, business vision, brand's ability to offer a really needed product. Partial application included the insufficient application of at least two of the offered factors of influence on the formation of brand valuation.

In the final stage, the author processed the obtained results through a t test of independent samples, with the aim of examining the difference between the partial and majority application of the corporate brand, that is, multiple regression analysis was used for the purpose of predicting state policy in relation to the partial and majority applied policy of the corporate brand. brand in agriculture.

Hypotheses

For the purposes of this study, the author made the following hypotheses.

H:1 There are no differences in the evaluation of the partial application of corporate marketing in relation to the majority application of corporate marketing, taking into account the application of the limiting factors of marketing in agriculture during 2021.

H:2 There are no differences in the evaluation of the partial application of corporate marketing in relation to the majority application of corporate marketing with respect to the application of the limiting factors of marketing in agriculture during the year 2022.

H:3 There are no differences in the evaluation of the partial application of corporate marketing in relation to the majority application of corporate marketing, taking into account the application of the limiting factors of marketing in agriculture during the year 2023.

H:4 There are no differences in the evaluation of the partial application of corporate marketing in relation to the majority application of corporate marketing, taking into account the application of the limiting factors of marketing in agriculture during the year 2024.

H: 5 that the conduct of state policy in the business of partial application of corporate marketing in agriculture cannot be predicted on the basis of four limiting factors of marketing.

H: 6 that the conduct of state policy in the business of majority application of corporate marketing in agriculture cannot be predicted on the basis of four limiting factors of marketing.

Data processing

Statistical processing of data followed by appropriate analyzes was carried out by the author using the software IBM SPSS (Statistical Package of Social Science), version 25.

In addition, the author applied an independent samples t test to examine the difference between partial and majority implementation of the corporate brand. factors are used: which will reflect the fragmentation of farms, the oversupply of agricultural products, the state policy that follows the area, the essential characteristics of agricultural products and the separation of products from consumers, to finally use multiple regression analysis. work on the prediction of state policy regarding the display of partial and majority applications of the corporate brand.

A level of 0.05 was applied for the threshold value of significance.

Results

The obtained results are grouped into four parts.

In the first part, there is a presentation of the realized differences of the analyzed factors in partial and majority application of the corporate brand in the period 2021-2024.

In the second part, the prediction of state policy factors in the partial application of the corporate brand is presented.

In the third part, the prediction of state policy factors in the majority application of the corporate brand is presented.

In the fourth part, a graphic presentation of the trend of limiting factors influencing the partial and majority application of the corporate brand is given.

The research examined whether there is a difference between partial and majority applications of the corporate brand based on the following factors: fragmentation of ownership, excessive supply of agricultural products, state policies, characteristics of agricultural products and separation of products from consumers, as well as their overall score for the period from 2021 to 2024.

To examine the differences, a t test of independent samples was used, and finally a multiple regression analysis was used for the purposes of predicting state policy, on the occasion of showing the partial and majority application of the corporate brand in the business of agricultural entities.

Presentation of the results of the application of the differences of the analyzed factors in legal entities that partly and mostly apply the corporate brand for the period 2021-2024

The author presented the obtained results of the twofold analysis of factors influencing the use of the corporate brand in the first year of observation in Table 1.

Table 1. Differences of the analyzed factors in relation to partial and majority application of the corporate brand for the year 2021

Factors	Partial implementation of the corporate brand (N=137)	The majority of the application of the corporate brand (N=73)	t	p
	Mean value			
Fragmentation of possessions	9.53 ± 0.56	4.95 ± 1.59	23.727	<0.0005*
Excessive supply of agricultural products	8.86 ± 0.92	9.21 ± 0.58	-3.363	0.001*
State policy	5.50 ± 1.15	7.30 ± 0.84	-12.891	<0.0005*
Characteristics of agricultural products	5.27 ± 1.20	6.68 ± 0.62	-11.199	<0.0005*
Separation of products from consumers	4.77 ± 1.07	6.53 ± 0.64	-14.821	<0.0005*
In total	6.78 ± 0.58	6.93 ± 0.20	-2.727	0.007*

*Statistical level of significance at the level of 0.05

Source: Author, 2024.

Based on the presentation of the results in Table 1, i.e. the results of the t test shown in Table 1, it can be seen that there is a statistically significant difference for all the analyzed limiting factors of the corporate brand, with the note that the factor fragmentation of ownership is stronger in the case of partial application of the corporate brand, while in the case of other factors as well as their overall score higher in the majority of corporate marketing applications for 2021.

The presentation of the obtained results of the analyzed factors that can influence the partial and majority use of the corporate brand in 2022 is presented by the author in Table 2.

Table 2. Differences of the analyzed factors in relation to partial and majority application of the corporate brand for the year 2022

Factors	Partial implementation of the corporate brand (N=137)	The majority of the application of the corporate brand (N=73)	t	p
	Mean value			
Fragmentation of possessions	9.56 ± 0.49	4.26 ± 1.57	28.107	<0.0005*
Excessive supply of agricultural products	9.00 ± 0.65	8.91 ± 0.82	0.789	0.393
State policy	5.46 ± 0.48	8.75 ± 0.82	-34.397	<0.0005*
Characteristics of agricultural products	5.28 ± 0.70	6.54 ± 1.29	-7.762	<0.0005*
Separation of products from consumers	3.86 ± 0.74	6.06 ± 1.03	-17.758	<0.0005*
In total	6.67 ± 0.38	6.90 ± 0.40	-4.163	0.005*

*Statistical level of significance at the level of 0.05

Source: Author, 2024.

Based on the presentation of the results in Table 2 as well as the t-test, it can be seen that for all types of limiting factors there is a statistically significant difference, except for the excessive supply of agricultural products, i.e. in the case of the fragmentation of holdings, there is a stronger influence with the partial application of the corporate brand, while the other factors and total a higher score for the majority of corporate brand applications in 2022.

The obtained results related to the analyzed factors that may influence the partial and majority use of the corporate brand in 2023 are presented in Table 3.

Table 3. Differences of the analyzed factors in relation to partial and majority application of the corporate brand for the year 2023

Factors	Partial implementation of the corporate brand (N=137)	The majority of the application of the corporate brand (N=73)	t	p
	Mean value			
Fragmentation of possessions	8.70 ± 0.45	4.32 ± 1.10	40.256	<0.0005*
Excessive supply of agricultural products	8.10 ± 0.83	8.53 ± 0.64	-4.076	<0.0005*
State policy	5.96 ± 0.74	8.15 ± 0.79	-19.859	<0.0005*
Characteristics of agricultural products	5.85 ± 0.65	7.75 ± 0.82	-18.137	<0.0005*
Separation of products from consumers	4.85 ± 0.65	7.36 ± 1.11	-17.743	<0.0005*
In total	6.69 ± 0.53	7.22 ± 0.41	-7.956	0.005*

*Statistical level of significance at the level of 0.05

Source: Author, 2024.

Based on the results of the t-test shown in Table 3, it can be seen that there are statistically significant differences for all factors of marketing restrictions, however, the fragmentation factor has a higher value in the partial application of corporate marketing, while the other factors and the total score are higher in the majority application of corporate marketing for 2023 year.

In Table 4, the author presented the results related to the analyzed factors that may affect the partial and majority use of the corporate brand in agriculture in 2024.

Table 4. Differences of the analyzed factors in relation to partial and majority application of the corporate brand for the year 2024

Factors	Partial implementation of the corporate brand (N=137)	The majority of the application of the corporate brand (N=73)	t	p
	Mean value			
Fragmentation of possessions	7.72 ± 0.44	3.75 ± 0.43	61.680	<0.0005*
Excessive supply of agricultural products	7.64 ± 0.48	6.75 ± 0.43	13.604	<0.0005*
State policy	6.27 ± 0.44	9.47 ± 0.50	-45.558	<0.0005*
Characteristics of agricultural products	7.00 ± 0.85	8.47 ± 0.50	-15.712	<0.0005*
Separation of products from consumers	5.72 ± 0.44	8.42 ± 0.57	-34.858	<0.0005*
In total	6.87 ± 0.26	7.37 ± 0.25	-13.491	0.005*

*Statistical level of significance at the level of 0.05

Source: Author, 2024.

Based on the results in Table 4 as well as the results of the t-test, it can be seen that for all individually considered limiting factors of the corporate brand, there is a statistically significant difference, although for the factors fragmentation of possessions and excessive supply of agricultural products, the obtained values are higher for the partial application of the corporate brand. while the values of the other factors and the total score are higher in the case of the majority application of the corporate brand for the year 2024.

Predicting State Policy Factors in the Case of Partial Corporate Brand Implementation

In this part of the presentation of the results, the author presented the results of the application of multiple linear regression in order to examine the analyzed factors, i.e. on the basis of: fragmentation of possessions, excessive supply of agricultural products, characteristics of agricultural products and the separation of products from consumers, it would be possible to predict the conduct of state policy based on partial implementation of the corporate brand.

The regression analysis yielded a coefficient of determination of 0.34, on the basis of which it can be seen that the obtained model describes 34% of the total variance. Government policy can be predicted based on independent variables as the model is statistically significant ($F=69.782$, $p<0.0005$).

Table 5. Prediction of government policy in relation to partial implementation of the corporate brand

	Beta	t	p
A constant	-	17.106	<0.0005*
Fragmentation of possessions	-0.609	-12.296	<0.0005*
Excessive supply of agricultural products	0.405	8.786	<0.0005*
Characteristics of agricultural products	0.135	2.804	0.005*
Separation of products from consumers	-0.22	-0.515	0.607

*Statistical level of significance at the level of 0.05

Source: Author, 2024.

Based on the results shown in Table 5, it can be seen that fragmentation of holdings, excessive supply of agricultural products and consumer product characteristics have a significant impact on the prediction of state policy for the partial implementation of corporate marketing.

Predicting state policy factors in the case of majority corporate brand application

At the end of the obtained results, a multiple linear regression was applied to examine whether, on the basis of fragmentation of holdings, excessive supply of agricultural products, characteristics of agricultural products and separation of products from consumers, it is possible to predict state policy based on the majority application of the corporate brand.

The presentation of the results is given in Table 6.

Table 6. Prediction of government policy in relation to majority application of the corporate brand

	Beta	t	p
A constant	-	21.928	<0.0005*
Fragmentation of possessions	-0.759	-17.177	<0.0005*
Excessive supply of agricultural products	-0.377	10.472	<0.0005*
Characteristics of agricultural products	-0.022	-0.342	0.005*
Separation of products from consumers	0.026	0.435	0.664

*Statistical level of significance at the level of 0.05

Source: Author, 2024.

The regression analysis yielded a coefficient of determination of 0.728, on the basis of which it can be seen that the obtained model describes 72.8% of the total variance. Government policy can be predicted based on the independent variables as the model is statistically significant (F=192.186, p<0.0005).

Based on the results shown in Table 6, it can be seen that fragmentation of holdings and excessive supply of agricultural products have a significant impact on the prediction of state policy for the majority application of the corporate brand.

Graphical presentation of the trend of limiting factors influencing the partial and majority application of the corporate brand

Finally, a visualization of the trend of limiting marketing factors for partial and majority application of the corporate brand for the observation period 2021-2024 is given.

To that end, Figure 1-2 is presented, which visually shows the influence of the analyzed factors on the corporate brand in agriculture.

Figure 1. Trend of limiting marketing factors for partial implementation of the corporate brand

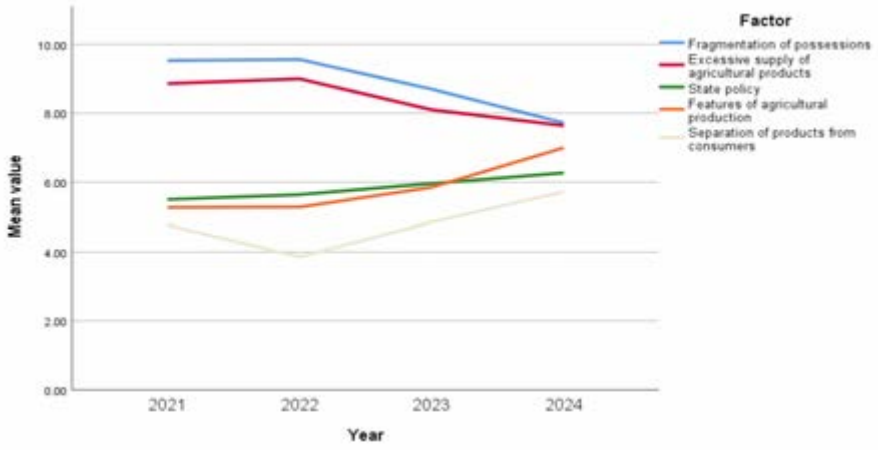
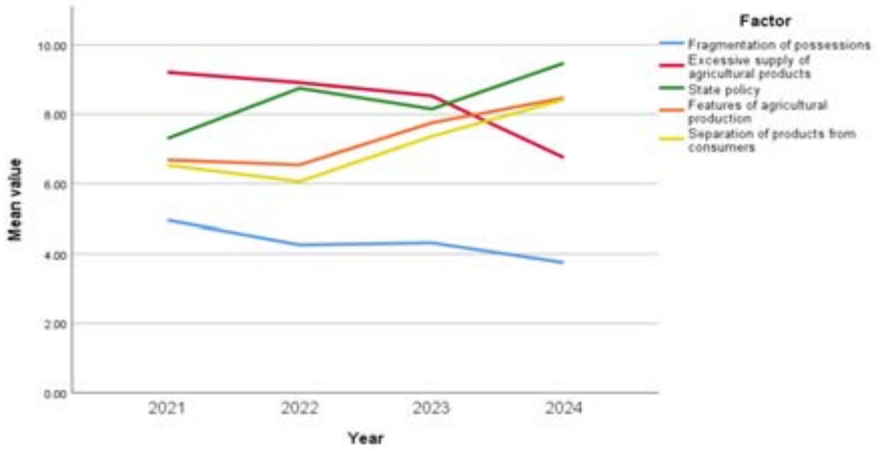


Figure 2. Trend of limiting marketing factors for the majority of corporate brand application



Discussion

Previous research in agriculture was focused on customer satisfaction, i.e. their needs, which essentially arose through market research, i.e. the demand for agriculture to make the desired product, which can be seen in the works (Meulenberg & Viaene, 1994; Henryks et al., 2016; Misra & Basu, 2024), which served as a basis for further in-depth observation of this problem through the innovative approach of the author of this study through the application of selected marketing limitation factors to business in the agricultural sector of the Republic of Serbia.

The innovative approach in the study was aimed at analyzing the impact of limiting factors on the partial and majority view of the corporate brand as the next stage of development in agrarian policy, which is largely visible in works such as (Nyagadza et al., 2021; Morrish et al., 2024), where it was hinted that it would go in future research on the specifics of corporate association, which in some way served as the basis for defining the goals in this study.

The obtained results shown in Tables 1-4 indicate that Hypotheses H:1, H:2, H:3, H:4 can be rejected because there are differences in valuation for all limiting factors of marketing in agriculture in relation to the partial and majority application of corporate marketing for the entire observation period 2021-2024. This is in accordance with the views expressed by authors such as (Uduji, et al., 2020; Wang et al., 2024, Xiang et al., 2024), where they went a step further by observing the problem of corporate action more broadly, raising it to the level of social relations, which coincides with the expectations of the authors of the study in the published results.

The new quality of this study was reflected in the fact that Hypotheses H:5 and H:6 can be rejected because the results obtained in Table 5-6 show that the state policy can be predicted based on the limiting factors of marketing in agriculture and their total score

in both partial and majority application of the corporate brand in agriculture of the Republic of Serbia, which was hinted at in a broader way of observation and coincides with already published works (Bless, 2024; Xiang et al., 2024).

The results of the study are reflected in a comprehensive presentation of the importance of researching the selected limiting factors of marketing in agriculture, especially when they are further viewed in relation to the partial and majority comparison with the application of corporate branding in agriculture. This research can serve as a basis for future research in which it is possible to investigate an even larger number of limiting factors of marketing in agriculture.

The results of this study were innovative in another segment, which is that predictions of future events in the conduct of state policy can be forecast based on the application of limiting marketing factors in agriculture in relation to the application of partial and majority branding in the organization of agriculture in the Republic of Serbia. In the end, this and the improved form of future research can be extended to other countries, so called. of the Western Balkans and beyond.

Conclusions

The current display of an upcoming corporate brand in agriculture was the focus of this study.

The main conclusion reached by the author of this study was that there is a significant difference in terms of evaluating the limiting factors of marketing, namely: fragmentation of holdings, excessive supply of agricultural products, state policies, characteristics of agricultural products, separation of agricultural products from consumers, as well as their total score in relation to the partial and majority application of the corporate brand in the organization of agricultural activities in the Republic of Serbia.

In addition, the author discovered that through the application of limiting factors, state policy can be predicted according to a model that is statistically significant ($F=69.782$, $p<0.0005$) for the partial application of the corporate brand, as well as that state policy can be predicted even more strongly in the case of the majority application of the corporate brand ($F=192.186$, $p<0.0005$) in the business of legal entities in agriculture in the Republic of Serbia.

Conflict of Interests

The authors declare no conflicts of interest.

References

1. Abeysiriwardana, P. C., Jayasinghe-Mudalige, U. K., & Seneviratne, G. (2022). Probing into the concept of 'research for society' to utilize as a strategy to synergize flexibility of a research institute working on eco-friendly commercial agriculture. *All Life*, *15*(1), 220–233. https://doi.org/10.1080/26895293.2022.2038280

2. Alavion, S. J., Allahyari, M. S., Al-Rimawi, A. S., & Surujlal, J. (2016). Adoption of Agricultural E-Marketing: Application of the Theory of Planned Behavior. *Journal of International Food & Agribusiness Marketing*, *29*(1), 1–15. https://doi.org/10.1080/08974438.2016.1229242

3. Ali, E., Egbendewe, A. Y. G., Abdoulaye, T., & Sarpong, D. B. (2020). Willingness to pay for weather index-based insurance in semi-subsistence agriculture: evidence from northern Togo. *Climate Policy*, *20*(5), 534–547. https://doi.org/10.1080/14693062.2020.1745742

4. Amsden, B., & McEntee, J. (2011). Agrileisure: re-imagining the relationship between agriculture, leisure, and social change. *Leisure/Loisir*, *35*(1), 37–48. https://doi.org/10.1080/14927713.2011.549194

5. Angioloni, S., Cerroni, S., Jack, C., & Ashfield, A. (2023). Eliciting farmers' preferences towards agriculture education in Northern Ireland. *The Journal of Agricultural Education and Extension*, *30*(4), 591–615. https://doi.org/10.1080/1389224X.2023.2249446

6. Aya Pastrana, N., Somerville, C., & Suggs, L. S. (2022). Integrating gender into social marketing programmes. *Journal of Marketing Management*, *38*(11–12), 1072–1103. https://doi.org/10.1080/0267257X.2022.2071964

7. Biddiscombe, P. (2019). Branding the United Nations: The Adoption of the UN Insignia and Flag, 1941–1950. *The International History Review*, *42*(1), 19–41. https://doi.org/10.1080/07075332.2018.1546216

8. Bless, A. (2024). The co-optation of regenerative agriculture: revisiting the corporate environmental food regime. *Globalizations*, 1–23. https://doi.org/10.1080/14747731.2024.2397260

9. Bocher, T. F., Okello, J. J., Sindi, K., Nshimiyimana, J. C., Muzhingi, T., & Low, J. W. (2020). Do Market-oriented Engendered Agriculture-health Interventions Affect Household Nutrition Outcomes: Evidence from an Orange-fleshed Sweetpotato Project in Rwanda. *Ecology of Food and Nutrition*, *60*(3), 304–323. https://doi.org/10.1080/03670244.2020.1845165

10. Brock, J. K. U. (2021). The emergence and implications of Technologized Marketing. *Journal of Global Scholars of Marketing Science*, *31*(3), 372–391. https://doi.org/10.1080/21639159.2021.1921607

11. Castro, R., & Sáiz, P. (2019). Cross-cultural factors in international branding. *Business History*, *62*(1), 1–25. https://doi.org/10.1080/00076791.2019.1592157

12. Cook, S., Jackson, E. L., Fisher, M. J., Baker, D., & Diepeveen, D. (2021). Embedding digital agriculture into sustainable Australian food systems: pathways and pitfalls to value creation. *International Journal of Agricultural Sustainability*, *20*(3), 346–367. https://doi.org/10.1080/14735903.2021.1937881

13. Dobryagina, N. (2020). Agricultural entrepreneurship fostering from behavioral decision theory perspective. Celebrity branding impact on financial and non-financial motivation. *The European Journal of Finance*, *29*(13), 1538–1554. https://doi.org/10.1080/1351847X.2020.1841663

14. El Chami, D., Trabucco, A., Wong, T., Monem, M. A., & Mereu, V. (2022). Costs and effectiveness of climate change adaptation in agriculture: a systematic review from the NENA region. *Climate Policy*, *22*(4), 445–463. https://doi.org/10.1080/14693062.2021.1997703

15. Ferdous, Z., Zulfiqar, F., Datta, A., Hasan, A. K., & Sarker, A. (2020). Potential and challenges of organic agriculture in Bangladesh: a review. *Journal of Crop Improvement*, *35*(3), 403–426. https://doi.org/10.1080/15427528.2020.1824951

16. Gebre, G. G., Isoda, H., Amekawa, Y., Rahut, D. B., Nomura, H., & Watanabe, T. (2021). Marketing Efficiency among Gender-Based Decision-Making Farm Households in Southern Ethiopia. *Journal of International Food & Agribusiness Marketing*, *34*(5), 538–563. https://doi.org/10.1080/08974438.2021.1911906

17. Gelgile, H. K., & Shukla, A. (2023). Digital Marketing as an Enabler of Sustainable Food System: The Mediating Role of Relationship Marketing. *Journal of International Food & Agribusiness Marketing*, *36*(1), 93–102. https://doi.org/10.1080/08974438.2023.2281324

18. Giri, A., & Chaulagai, T. R. (2024). Enhancing sustainable agriculture through innovative packaging: consumer preferences and willingness to pay in the Nepalese market. *Cogent Food & Agriculture*, *10*(1). https://doi.org/10.1080/23311932.2024.2399793

19. Gomiero, T., Pimentel, D., & Paoletti, M. G. (2011). Is There a Need for a More Sustainable Agriculture? *Critical Reviews in Plant Sciences*, *30*(1–2), 6–23. https://doi.org/10.1080/07352689.2011.553515

20. Gordeev, R. V. (2020). Competitiveness of Forest Sector Products: Lessons from an Analysis of External Trade. *Problems of Economic Transition*, *62*(1–2), 44–60. https://doi.org/10.1080/10611991.2020.1895600

21. Hackley, C. (2022). Crap detecting. Autoethnographic reflections on critical practice in marketing pedagogy. *Journal of Marketing Management*, *39*(1–2), 20–31. https://doi.org/10.1080/0267257X.2022.2132754

22. Henryks, J., Ecker, S., Turner, B., Denness, B., & Zobel-Zubrzycka, H. (2016). Agricultural Show Awards: A Brief Exploration of Their Role Marketing Food Products. *Journal of International Food & Agribusiness Marketing*, *28*(4), 315–329. https://doi.org/10.1080/08974438.2015.1110547

23. Huang, C., & Chen, Y. (2021). RETRACTED ARTICLE: Agricultural business and product marketing effected by using big data analysis in smart agriculture. *Acta Agriculturae Scandinavica, Section B — Soil & Plant Science*, *71*(9), 980–991. https://doi.org/10.1080/09064710.2021.1967439

24. Hunt, S. D. (2017). Advancing marketing strategy in the marketing discipline and beyond: from promise, to neglect, to prominence, to fragment (to promise?). *Journal of Marketing Management*, *34*(1–2), 16–51. https://doi.org/10.1080/0267257X.2017.1326973

25. Kaki, R. S., Gbedomon, R. C., Thoto, F. S., Houessou, D. M., Gandji, K., & Aoudji, A. K. N. (2022). Skills mismatch in the agricultural labour market in Benin: vertical and horizontal mismatch. *International Journal of Lifelong Education*, *41*(3), 343–365. https://doi.org/10.1080/02601370.2022.2075480

26. Kamin, T., Kubacki, K., & Atanasova, S. (2022). Empowerment in social marketing: systematic review and critical reflection. *Journal of Marketing Management*, *38*(11–12), 1104–1136. https://doi.org/10.1080/0267257X.2022.2078864

27. Kazungu, I. (2024). African indigenous vegetable marketing: examining the influence of socio-economic factors and market patterns in Tanzania. *Cogent Business & Management*, *11*(1). https://doi.org/10.1080/23311975.2024.2321856

28. Khalil, S., & Villace, T. (2021). Marketing–Quality Interface: An Empirical Analysis of FMCG Customers. *Cogent Business & Management*, *8*(1). https://doi.org/10.1080/23311975.2021.1885574

29. Ligaraba, N., Chuchu, T., & Nyagadza, B. (2023). Opt-in e-mail marketing influence on consumer behaviour: A Stimuli–Organism–Response (S–O–R) theory perspective. *Cogent Business & Management*, *10*(1). https://doi.org/10.1080/23311975.2023.2184244

30. Liu, J., Liu, F., & Webb, D. (David). (2023). Examining the effectiveness of a tourism–agriculture co-marketing alliance: an empirical study of fit and fit priming. *Tourism Recreation Research*, 1–17. https://doi.org/10.1080/02508281.2023.225267

31. Masikati, P., Sisito, G., Chipatela, F., Tembo, H., & Winowiecki, L. A. (2021). Agriculture extensification and associated socio-ecological trade-offs in smallholder farming systems of Zambia. *International Journal of Agricultural Sustainability*, *19*(5–6), 497–508. https://doi.org/10.1080/14735903.2021.1907108

32. Mazumder, M. S. U., & Kabir, M. H. (2022). Farmers' adaptations strategies towards soil salinity effects in agriculture: the interior coast of Bangladesh. *Climate Policy*, *22*(4), 464–479. https://doi.org/10.1080/14693062.2021.2024126

33. Meulenberg, M., & Viaene, J. (1994). Agricultural Marketing in Belgium and the Netherlands. *Journal of International Food & Agribusiness Marketing*, *5*(3–4), 141–161. https://doi.org/10.1300/J047v05n03_08

34. Misra, K., & Basu, D. (2024). To Reform and to Procure: An Analysis of the Role of the State and the Market in Indian Agriculture. *The Journal of Development Studies*, *60*(5), 724–744. https://doi.org/10.1080/00220388.2024.2312845

35. Mishra, A., Ketelaar, J. W., Uphoff, N., & Whitten, M. (2021). Food security and climate-smart agriculture in the lower Mekong basin of Southeast Asia: evaluating impacts of system of rice intensification with special reference to rainfed agriculture. *International Journal of Agricultural Sustainability*, *19*(2), 152–174. https://doi.org/10.1080/14735903.2020.1866852

36. Morrish, S. C., Wolf, H., & Meriluoto, L. (2022). Internationalization and the wine industry: an entrepreneurial marketing approach. *Journal of Wine Research*, *33*(1), 40–55. https://doi.org/10.1080/09571264.2022.2045922

37. Nasr Ahmed, Y., Delin, H., Belford, C., Shaker, V., & Abdelrahaman, N. A. M. (2020). An estimate of the potential economic impacts of climate change on Egypt's agriculture: a multi-market model approach. *Climate and Development*, *13*(3), 228–241. https://doi.org/10.1080/17565529.2020.1754156

38. Nyagadza, B., Kadembo, E. M., Makasi, A., & Feng, G. C. (2020). Corporate storytelling for branding: Underpropping or thwarting internal stakeholders' optimistic corporate brand perceptions? *Cogent Social Sciences*, *6*(1). https://doi.org/10.1080/23311886.2020.1845926

39. Nyagadza, B., Kadembo, E. M., Makasi, A., & Walla, P. (2021). When corporate brands tell stories: A signalling theory perspective. *Cogent Psychology*, *8*(1). https://doi.org/10.1080/23311908.2021.1897063

40. Nyagango, A. I., Sife, A. S., & Kazungu, I. (2023). Factors influencing the use of mobile phone for accessing agricultural marketing information by grape smallholder farmers in Tanzania. *Cogent Business & Management*, *10*(3). https://doi.org/10.1080/23311975.2023.2257865

41. Pircher, T., Nertinger, M., Goss, L., Hilger, T., Karungi-Tumutegyereize, J., Waswa, L., & Knierim, A. (2022). Farmer-centered and structural perspectives on innovation and scaling: a study on sustainable agriculture and nutrition in East Africa. *The Journal of Agricultural Education and Extension*, *30*(1), 137–158. https://doi.org/10.1080/1389224X.2022.2156894

42. Rossi, J., & Woods, T. (2024). Placing community supported agriculture in local food systems. *International Journal of Agricultural Sustainability*, *22*(1). https://doi.org/10.1080/14735903.2024.2318936

43. Sheth, J. (2021). New areas of research in marketing strategy, consumer behavior, and marketing analytics: the future is bright. *Journal of Marketing Theory and Practice*, *29*(1), 3–12. https://doi.org/10.1080/10696679.2020.1860679

44. Shruthi Priya, G., & Sathish, A. S. (2024). Storytelling alchemy in marketing: unveiling future research directions with ADO TCM framework. *Cogent Business & Management*, *11*(1). https://doi.org/10.1080/23311975.2024.2392257

45. Siankwilimba, E., Hiddlestone-Mumford, J., Hoque, M. E., Hang'ombe, B. M., Mumba, C., Hasimuna, O. J., … Prayitno, G. (2023). Sustainability of agriculture extension services in the face of COVID-19: A study on gender-specific market systems. *Cogent Food & Agriculture*, *9*(2). https://doi.org/10.1080/23311932.2023.2284231

46. Skogstad, G. (2020). Political Parties and Policy Change in Canadian Agricultural Marketing Institutions. *Journal of Comparative Policy Analysis: Research and Practice*, *23*(5–6), 561–575. https://doi.org/10.1080/13876988.2020.1749519

47. Su, Y., Grashuis, J., Roach, A., & Moreland, J. (2022). Specialty Crop Consumer Preferences for Product Characteristics and Marketing Channels. *Journal of International Food & Agribusiness Marketing*, *34*(2), 195–213. https://doi.org/10.1080/08974438.2022.2049416

48. Strauss, J., Swanepoel, P., Laker, M., & Smith, H. (2021). Conservation Agriculture in rainfed annual crop production in South Africa. *South African Journal of Plant and Soil*, *38*(3), 217–230. https://doi.org/10.1080/02571862.2021.1891472

49. Swanepoel, J. W., Van Niekerk, J. A., & Tirivanhu, P. (2021). Analysing the contribution of urban agriculture towards urban household food security in informal settlement areas. *Development Southern Africa*, *38*(5), 785–798. https://doi.org/10.1080/0376835X.2021.1920888

50. Tamtomo, K. (2021). Unarticulated tensions in the marketization of organic agriculture: the case of pioneer organizations in Yogyakarta, Indonesia. *South East Asia Research*, *29*(2), 195–213. https://doi.org/10.1080/0967828X.2021.1931422

51. Trejo-Pech, C. O., & Thach, S. (2021). A review of articles in the *Journal of Global Scholars of Marketing Science (JGSMS)* special issue on Marketing Management in International Contexts. *Journal of Global Scholars of Marketing Science*, *31*(1), 1–9. https://doi.org/10.1080/21639159.2020.1808816

52. Uduji, J. I., Okolo-Obasi, E. N., Onodugo, V. A., Nnabuko, J. O., & Adedibu, B. A. (2020). Corporate social responsibility and the role of rural women in strengthening agriculture-tourism linkages in Nigeria's oil producing communities. *Journal of Tourism and Cultural Change*, *19*(6), 754–780. https://doi.org/10.1080/14766825.2020.1826500

53. van Antwerpen, R., Laker, M., Beukes, D., Botha, J., Collett, A., & du Plessis, M. (2021). Conservation Agriculture farming systems in rainfed annual crop production in South Africa. *South African Journal of Plant and Soil*, *38*(3), 202–216. https://doi.org/10.1080/02571862.2020.1797195

54. van der Merwe, M. (2024). How do we secure a future for the youth in South African agriculture? *Agrekon*, *63*(1–2), 1–15. https://doi.org/10.1080/03031853.2024.2341511

55. Wang, X., Hua, C., & Miao, J. (2022). The spatial effect of factor market distortion on green agriculture development in China. *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, 1–17. https://doi.org/10.1080/15567036.2022.2027579

56. Weber, H., Loschelder, D. D., Lang, D. J., & Wiek, A. (2021). Connecting consumers to producers to foster sustainable consumption in international coffee supply – a marketing intervention study. *Journal of Marketing Management*, *37*(11–12), 1148–1168. https://doi.org/10.1080/0267257X.2021.1897650

57. Xiang, X., Chen, M., & Zhang, X. (2024). Does regional branding promote or inhibit dual innovation? An empirical study based on 298 agriculture-related enterprises in China. *Technology Analysis & Strategic Management*, 1–14. https://doi.org/10.1080/09537325.2024.2416006

58. Yang, F., Wang, X. F., Cao, H., & Lu, D. (2017). The competitive strategy of producing and marketing docking platform of agriculture products. *Journal of Interdisciplinary Mathematics*, *20*(3), 659–667. https://doi.org/10.1080/09720502.2016.1259858

59. Yaseen, M., & Ahmad, M. M. (2019). Appropriateness of agricultural marketing information service in Punjab, Pakistan. *Development in Practice*, *30*(3), 308–319. https://doi.org/10.1080/09614524.2019.1656709

THE EFFECTS OF INTERNAL GREEN MARKETING ON JOB SATISFACTION AND FINANCIAL OUTCOMES – THE CASE OF THE SERBIAN AGRIBUSINESS SECTOR

Vesna Milanović[1], Vesna Miletić[2], Aleksandra Jagodić Rusić[3], Jasmina Poštin[4]

**Corresponding author E-mail: vmilanovic555@gmail.com*

ARTICLE INFO

Original Article

Received: *03 November 2024*

Accepted: *02 December 2024*

doi:10.59267/ekoPolj2501107M

UDC 658.8:502.1(497.11)

Keywords:

internal green marketing - IGM, job satisfaction - JS, financial outcomes - FOs, agribusiness sector organizations

***JEL**: M31, D23, M12, G30, Q19*

ABSTRACT

The purpose of this paper was to examine the effects of internal green marketing (IGM) on managers' job satisfaction (JS) and organizational financial outcomes (FOs). An online survey was used to collect data. On the sample of 78 managers of medium-sized and large organizations in the Serbian agribusiness sector, using partial least squares structural equation modeling technique, the results showed that IGM positively affects managers' JS and FOs of the organizations. They also revealed that managers' JS affects FOs, but also partially mediates the link between IGM and FOs. These results emphasize the significant role of IGM in improving managers' JS and organizational FOs, but the importance of nurturing managers' JS as one of the job-related attitudes. The main contribution of this paper is the establishment of the link between these variables, as well as the testing of the assumed relationships in the agribusiness context in which the relationships between these variables have not been tested before.

Introduction

Internal green marketing (IGM) reflects the ability and willingness of employees to contribute to environmental protection and be one of the sources and drives of the organization's competitive advantage. However, implementing the IGM concept

1 Vesna Milanović, full professor, University "MB", Belgrade, Faculty of Business and Law, Teodora Drajzera 27, 11000, Belgrade, Serbia, Phone: +38111-3391-641, E-mail: vmilanovic555@gmail.com, ORCID ID (https://orcid.org/0000-0001-8574-732X)

2 Vesna Miletić, full professor, University "MB", Belgrade, Faculty of Business and Law, Teodora Drajzera 27, 11000, Belgrade, Serbia, Phone: +38111-3391-641, E-mail: vmiletic68@gmail.com, ORCID ID (https://orcid.org/0000-0003-1287-5800)

3 Aleksandra Jagodić Rusić, director, High school "Sava Tekelija", Pančevo, Maksima Gorkog 25, 26000, Pančevo, Serbia, Phone: +38164-442-3503, E-mail: aleksandra@rusic.rs, ORCID ID (https://orcid.org/0009-0005-3876-7615)

4 Jasmina Poštin, assistant professor, University "Union-Nikola Tesla", Belgrade, Faculty of Management, Njegoševa 1a, 21205, Sremski Karlovci, Serbia, Phone: +38169-2576-288, E-mail: jasminapostin@gmail.com, ORCID ID (https://orcid.org/0000-0003-3707-7522)

requires investing with patience. That is the key to this long-term process, which must simultaneously be supported by a high level of managers' awareness of the importance of adopting the IGM philosophy and its dissemination among employees, as well as a high level of their job satisfaction (JS). Therefore, researchers are beginning to pay attention to examining the relationship between IGM, (managers') JS, and financial outcomes (FOs) of the organizations (Milanović et al., 2022; Qureshi, Mehraj, 2022; Shababi, Golestani, 2022). This is of great significance, as environmentally sensitive organizations strive to balance value creation and cost reduction, integrating the principles of sustainability.

Although the relevant literature suggests that various internal and green practices can influence employees'/managers' JS (e.g. internal marketing: Bailey et al., 2016; green human resource management: Freire, Pieta, 2022; etc.), organizational performance (e.g. green marketing orientation: Chahal et al., 2014; green marketing strategy: Fraj et al., 2011; etc.) as well as environmental protection (e.g. market-oriented sustainability: Crittenden et al., 2011), the authors of this paper believe that above-mentioned variables can be affected by IGM. This is supported by the fact that the internal marketing practices can improve employees' JS, while satisfied employees can improve the level of customers' satisfaction (Ahmed, Rafiq, 2003). In addition, green marketing orientation (GMO) leads to better business performance of the organization (internal green marketing orientation – IGMO is one of the GMO dimensions, Papadas et al., 2017, p. 236). Meanwhile, a positive direct effect of IGM on employees' satisfaction (Qureshi, Mehraj, 2022) and a positive direct effect of IGMO on business performance of the organization (Elshaer et al., 2024) have been empirically confirmed. Therefore, IGM has the potential to foster employees'/managers' JS and organizational FOs. However, there is a lack of studies on the effects of IGM on managers' JS and FOs of the organizations, particularly the studies on the relationship between these variables in organizations operating in the agribusiness sector, as opposed to the studies on the effects of internal marketing on employees' JS, other job-related attitudes, and performance. Therefore, this paper aims to fill the gap in the literature on IGM by examining the effects of IGM on organizational FOs with managers' JS as a mediating variable in the relationship between IGM and FOs of the organizations operating in Serbian agribusiness environment. This paper expands the knowledge about IGM and its effects on managers' JS as one of the job-related attitudes as well as on organizational FOs as one of the organizational success indicators. The results of this paper contribute to the understanding of the impact of IGM as a new marketing practice on JS and FOs. For managers of the agribusiness organizations, the results of this paper provide an insight into how to use IGM to improve JS, and thereby organizational FOs.

Conceptual framework and the development of hypotheses

Customer-oriented organizations are focused on meeting the needs, wants and expectations of their customers as the most important external stakeholders. Therefore, *customer orientation* is key to market outcomes, and "concurrently practicing *customer*

orientation and *employee orientation* only increases long-term financial performance" (Lee, Wei, 2023, the first page). These orientations, that is, *customer-oriented employees* are the basis of the internal marketing concept (Ahmed, Rafiq, 2003). In modern conditions, organizations include an ecological dimension into their business activities in order to contribute to the environment protection, but also to achieve a competitive advantage, nurturing *customer-* and *environment orientation* among employees (the core of the IGM concept). Therefore, the IGM concept recognizes the role of employees in value creation. In addition, it emphasizes the importance of *customer-oriented employees* who are also *environmentally oriented* (employees as internal customers; employees as internal stakeholders). In line with that, Papadas et al. (2017) note that stakeholder integration is critical to an organization's level of green marketing practices. However, concurrently practicing organization's orientation towards different groups - customers, employees, but also the environment, as well as other stakeholders can produce different benefits and costs. Therefore, not all organizations are ready and able to balance the benefits and costs while integrating the sustainability dimension into their operations or adopting a green orientation. IGM (orientation) can be a good way to develop environmental orientation, since it refers to the environmentally oriented activities within the organization that promote environmentally friendly culture, eco-friendly practices and behaviors (Papadas et al., 2017). In addition, IGM can help ensure that all employees share the same vision and green values, since that "in general, the advancement of new ways of thinking and efforts to develop an environmental orientation throughout the firm are possible when all members of the organization share the same vision as top management" (Charter & Polonsky, 1999 as cited in Papadas et al., 2017, p. 239).

According to Qureshi and Mehraj (2022, p. 791) "...internal green marketing (IGM) is defined as the extent to which an organization involves endorsing environmental values and develops a wider corporate green culture across the organization." As Chang (as cited in Elshare, 2024, p. 213) indicated "executive management may urge each staff member to embrace green practices and reap the rewards by using IGMO." As a result, there could be an increase in overall employees' satisfaction and their JS (Qureshi, Mehraj, 2022). JS is "a pleasurable or positive emotional state resulting from the appraisal of one's job or job experiences" (Locke, 1976, p. 1304 as cited in: Judge, Klinger, 2008, p. 394). As a global concept, JS includes various facets such as the work itself, working conditions, pay, promotion, recognition, cooperation and coworkers, supervision, management (see more: Judge, Klinger, 2008, p. 395). Therefore, JS as a job-related attitude refers to the degree to which an employee (e.g. manager) is satisfied with his or her job and its facets. Successful organizations implement the motivation programs for both managers and employees in order to increase their satisfaction and improve their performance (one of them are the IGM programs). In addition to the fact that organizations strive for satisfied customers, employees and other stakeholders as well as environmental protection, they also strive to achieve high business performance, and thereby financial outcomes. Organizational FOs refer to

a set of individual outcomes such as sales and profit growth, cost reduction, market share, etc. In order to gain an insight into the relations between the observed variables (IGM, managers' JS, and organizational FOs), this paper relies on the relevant literature and rare empirical studies. Namely, employees take positive job-related attitudes in the internal marketing environment (Ahmed, Rafiq, 2003), so it is expected that they will take such attitudes in the internal green marketing environment, as well. One of the positive job-related attitudes of employees or managers is job satisfaction (JS). It has been empirically confirmed that IGM affects JS (the case of consumer, industrial, and service industries: Qureshi & Mehraj, 2022). Satisfied employees achieve better performance in the internal marketing environment (Gross, Rottler, 2019). They can also affect organizational performance (Chen et al., 2015 and Shabbir, Salaria, 2014 as cited in Huang et al., 2019). Papadas et al. (2017, p. 236) state that organizations adopt the practice of green marketing to achieve better business performance, since green marketing is "an essential tool for sustainable business strategy". In line with that, it has been confirmed that IGMO affects business performance (the case of the tourism and hospitality industry: Elshaer et al., 2024). To the authors' knowledge, there are no previous studies conducted in the IGM context that examine the relationship between JS and organizational FOs. In addition, the direct effect of IGM on financial performance was rarely tested (e.g. Milanović et al., 2022). Some studies confirmed the positive indirect effect of IGM on performance. Namely, IGM affects organizational performance through competitive advantage (the case of the banking sector: Shababi, Golestani, 2022). In addition, IGM affects financial performance through organizational identification (the case of the agribusiness sector: Milanović et al. 2022). Although certain relationships between the observed variables (IGM; JS, FOs) have been confirmed, there is little research on the relationship between them, especially the research conducted in the agribusiness sector. In regard with that, the purpose of the paper is to examine the direct effect of IGM on both JS and FOs, as well as the mediating role of JS in the relationship between IGM and FOs. Finally, it is assumed that:

H1: IGM has a positive direct effect on managers' JS.

H2: Managers' JS has a positive direct effect on organizational FOs.

H3a: IGM has a positive indirect effect on organizational FOs through managers' JS.

H3b: IGM has a positive direct effect on organizational FOs.

Methodology

Data collection: Data collection for testing the hypotheses in this paper was carried out by an online survey. The sample consisted of managers of medium-sized and large organizations operating in the Serbian agribusiness sector. The research was conducted in the period December 2023 - May 2024. The contacts of managers of the agribusiness sector organizations were acquired through various e-sources (*All companies in Serbia,* https://kompanije.co.rs; *Agriculture sphere* (https://www.poljosfera.rs/agrosfera/adresar/; *Best of Serbia*, https://www.bestofserbia.rs; etc.), as well as through personal contacts.

Sample: According to the latest data from the Statistical Office of the Republic of Serbia, the number of business entities in the relevant sectors in Serbia in 2021 was 1879, that is, the number of medium-sized business entities was 1508 while the number of large-sized business entities was 371 (Agriculture, forestry and fishing: 82 and 6, Manufacturing industry: 949 and 270, Wholesale and retail trade and repair of motor vehicles: 477 and 95, respectively; as cited in Enterprises by size and entrepreneurs in the Republic of Serbia 2019-2021, 2023, *Table 1.1.6*). More precisely, according to the data of the Serbian Business Registers Agency, the number of medium-sized and large business entities in the agribusiness sector at the end of 2017 in the Serbia amounted to 432, of which medium-sized: 350, and large: 82 (as cited in The analysis of prospective occupations in the agro-business sector, *Table 7*). The medium-sized (50-249 employees) and large organizations (>249 employees) were selected for this research, since these organizations have a greater potential and resources for implementing IGM practices.

From 323 distributed questionnaires 78 completed questionnaires were returned (the response rate is 24.15%).

Sample structure: The sample structure is presented in *Table 1* and *Table 2*.

Table 1. Characteristics of the organizations surveyed (N=78)

Size	**%**
Medium	46.16
Large	53.84
Sector	
"A" - Division 01 "Agricultural production, hunting and related service activities"	10.25
"C" - "Manufacturing" (Division C10: food products; Division C11: beverages)	71.79
"G" - Division 47 "Retail trade, except of motor vehicles and motorcycles"	17.96

Source: Authors' calculation

Table 2. The structure of the respondents in the sample (N=78)

The gender distribution of the respondents	**%**
Female	35.90
Male	64.10
The age distribution of the respondents	**%**
<31	23.07
31-40	28.21
41-50	25.64
51-60	20.51
>60	2.57
The educational distribution of the respondents	**%**
Secondary	10.26
Higher	89.74
The position of the respondents	**%**
General or executive manager	66.67
Financial manager	7.69
Marketing manager	12.82
Human resource manager	12.82

Source: Authors' calculation

There are slightly more large-sized organizations in the sample compared to medium-sized organizations.The largest number of the organizations in the sample operates in manufacturing - Sector C (*Table 1*). The sample includes more male, managers with higher education and those whose position is general or executive manager (*Table 2*).

Measurement scales: IGM is the first construct in this research. IGM refers to the level to which an organization advocates and endorses green, eco or environmental values and develops organizational green culture (adapting to Qureshi, Mehraj, 2022). This research used 15-items from Qureshi and Mehraj (2022, *Table 3*): green internal communication (5 items; GIC4 is GIC3, GIC5 is GIC4 and GIC6 is GIC5, green skill development (five items; GSD), and green rewards (five items; GRs). JS is the second construct in this research. JS is defined as the level to which managers are satisfied with the job and its facets (the job itself, freedom in the workplace, the activities that the work offers, opportunities to interact with others, etc.). A low level of JS can increase employees' intentions to leave their current job, especially when another job opportunity is presented to them (King, Grace, 2010 as cited in Huang et al., 2019). Therefore, it is vital to measure JS. Managers' JS as a reflective construct was measured by five items (the scale from Huang et al., 2019, *Table 3*). The respondents (managers) were asked to indicate the extent to which they agreed with statements (offered in the survey) regarding IGM and JS (a scale of 1 i.e. strongly disagree to 5 i.e. strongly agree). FOs refer to the financial success and effectiveness of the organization in achieving its financial goals and objectives (adapting to Zsidó, 2015 as cited in Elshaire et al., 2024). It involves various indicators such as sales growth, organization's profitability, organization's economic results, profit before tax, and market share (Morgan et al., 2004 as cited in Papadas et al., 2019, *Table 2*). Measuring FOs helps identify areas and activities that the organization needs to improve. A subjective measure of FOs is still used in many studies. In line with that, a subjective measure of FOs was used in this paper. This paper adopted the 5-item scale of FOs proposed by Morgan et al., 2004 (as cited in Papadas et al., 2019, *Table 2*). Namely, the indicator „organization's economic results" was excluded while the indicator „costs reduction„ is included in this research. The managers were asked to rate the level of sales growth (FOs1), the level of profitability growth (FOs2), the level of costs reduction (FOs3); the level of profit before tax growth (FOs4) as well as the level of market share growth (FOs5) that were achieved in 2022 (1 – not achieved at all, 5 – fully achieved).

Data analysis: For testing the hypotheses, partial least squares structural equation modeling technique (PLS-SEM) was used. The calculations were done in SmartPLS 4.1.0.4. software. Following suggestions in the literature, a two-step procedure (Hair et al., 2017), and the disjoint two-stage approach (Becker et al., 2012; Sarstedt et al., 2019) were applied. The obtained results are presented below.

Results

Measurement model assessment: Factor analysis (PLS algorithm function) was conducted in order to assess reliability and validity of measurement scales. Summarized results from both stages of the disjoint two-stage approach are given in *Table 3* alongside descriptive statistics for all indicators used in the research.

Table 3. Descriptive statistics, reliability and convergent validity

Constructs and their indicators	Mean	St. Dev.	Factor loadings	Cronbach's alpha	CR	AVE
IGM (second-order refl. con.)	3.424	0.023		*0.902*	*0.938*	*0.835*
GIC (first-order reflective con.)	3.719	0.087	*0.909*	0.935	0.951	0.796
GIC1	4.103	0.988	0.872			
GIC2	3.923	1.078	0.941			
GIC3	3.667	1.077	0.840			
GIC4	3.795	1.049	0.936			
GIC5	3.821	1.225	0.866			
GSD (first-order reflective con.)	3.549	0.087	*0.913*	0.886	0.917	0.689
GSD1	3.333	1.124	0.880			
GSD2	3.641	1.032	0.838			
GSD3	3.974	1.006	0.691			
GSD4	3.692	0.971	0.856			
GSD5	3.103	1.180	0.872			
GRs (first-order reflective con.)	3.005	0.047	*0.920*	0.941	0.956	0.813
GRs1	3.026	1.238	0.937			
GRs2	3.051	1.205	0.965			
GRs3	3,000	1,206	0.925			
GRs4	2.256	1.156	0.866			
GRs5	3.692	1.120	0.807			
Managers' JS (reflective const.)	4.400	0.089		0.832	0.882	0.600
JS1	4.385	0.649	0.760			
JS2	4.321	0.747	0.842			
JS3	4.603	0.671	0.777			
JS4	4.423	0.730	0.821			
JS5	4.269	0.878	0.661			
Organ. FOs (reflective const.)	4.077	0.118		0.820	0.877	0.595
FOs1	4.256	0.904	0.844			
FOs2	4.077	1.125	0.875			
FOs3	3.872	0.972	0.597			
FOs4	3.872	1.049	0.874			
FOs5	4.308	0.827	0.616			
*Note: Italics were used for the values obtained in the second stage of the disjoint two-stage approach						

Source: Authors' calculation

Cronbach's alpha coefficient (Ch. Alpha), composite reliability (CR), and average variance extracted (AVE) were used in order to assess internal consistency and reliability of measurement scales, since all constructs in the model were reflective. All factor loadings were above 0.5 as it is recommended in literature (Hair et al., 2014). Thus, reliability was established. Internal consistency was also established since Ch. Alpha and CR were above 0.7 (Churchill, 1979; Diamantopulous et al., 2012). CR values were above 0.7, AVE values were above 0.5, and CR values were greater than AVE values for all constructs in the tested model (Fornell, Larker, 1981) showing that there were no convergent validity issues.

Heterotrait-monotrait (HTMT) ratio is presented in *Table 4*.

Table 4. HTMT ratio

	FOs	GIC	GRs	GSD	IGM
GIC	0.488				
GRs	0.468	0.843			
GSD	0.612	0.765	0.801		
IGM	*0.568*	n.a.	n.a.	n.a.	
JS	0.813	0.400	0.362	0.545	*0.474*
*Note: Italics were used for the values obtained in the second stage of the disjoint two-stage approach					

Source: Authors' calculation

Heterotrait-monotrait (HTMT) ratio was used for the assessment of discriminant validity following suggestions of Henseler et al. (2015). HTMT values were lower than 0.9 for all constructs in the model (see *Table 4*). Thus, discriminant validity was established.

Structural model assessment: In order to ensure that collinearity was not an issue, VIF values were observed, and they were lower than 3 for both exogenous constructs in the model (VIF_{IGM}=1.222; VIF_{JS}=1.222) as it is suggested in literature (Hair et al., 2017).

The quality of the structural model was assessed based on coefficient of determination (R^2) and Stone-Geisser's Q^2 value (Geisser, 1974; Shmueli, Koppius, 2011; Stone, 1974). The results showed that more than 50% of the variance in FOs was explained by independent variables in the model (R^2_{FOs}=0.508). R^2 for the dependent variable JS was 0.182. These results are considered good in social sciences research (Falk, Miller, 1992). In order to calculate Q^2, PLSpredict procedure was used (number of folds=10). Values of Q^2 for all dependent variables were above zero (Q^2_{FOs}=0.224; Q^2_{JS}=0.156) as it is required in literature (Hair et al., 2019).

For testing the hypotheses, the bootstrap procedure was used (5,000 subsamples; BCa method; two-tailed t-test; 5% significance level). The obtained results are presented in *Table 5*.

Table 5. Testing of the hypotheses

Hypotheses	β coefficient	t-values	p-values	Supported
H1: IGM -> JS	0.437	5.576	0.000	yes
H2: JS -> FOs	0.537	3.785	0.000	yes
H3a: IGM -> JS -> FOs	0.240	2.643	0.008	yes
H3b: IGM -> FOs	0.275	2.391	0.017	yes

Source: Authors' calculation

Based on the obtained results (*Table 5*), the first hypothesis (H1) was confirmed showing that IGM has a positive impact on managers' JS (β=0.437; $p < 0.001$). The second hypothesis suggested that managers' JS had a positive effect on organizational FOs (H2) which was also confirmed by the results (β=0.537; $p < 0.001$). The analysis affirmed that there is a positive and direct relationship between IGM and organizational FOs (β=0.275; $p<0.05$). However, there is also an indirect effect of IGM on organizational FOs through managers' JS (β=0.240; $p < 0.05$). The mediation of the managers' JS variable is partial, since both direct and indirect effects were shown to be positive and statistically significant. All of this led to the confirmation of the third hypothesis (H3a and H3b).

Additionally, to uncover if the effects in the proposed model were meaningful, Cohen's f^2 values (Cohen, 1988) were observed. The results showed that all effects were meaningful. The effect of IGM on organizational FOs appeared to be small but meaningful (f^2=0.124). The effect of IGM on managers' JS was medium in size (f^2=0.222), and the effect of managers' JS on organizational FOs was large (f^2=0.508).

Discussion

By adopting and implementing IGM, organizations can more easily create an internal culture based on green values and sustainability, thereby improving job-related attitudes of managers and other employees, as well as organizational performance (financial and non-financial performance, especially marketing and environmental performance, etc.). Regarding the direct relationship between IGM and organizational FOs in the agribusiness sector organizations, there is a lack of the studies on this topic. However, some studies (e.g. Milanović et al., 2022) highlight the potential of the indirect relationship between these variables in the agribusiness sector. Similarly, the studies that have examined the relationship between IGM and JS (e.g. Qureshi, Mehraj, 2022) as well as the relationship between JS and organizational FOs in the IGM context, especially in the organizations operating in the agribusiness sector, are scarce. Therefore, the obtained results in this paper are significant.

The first result of the conducted research showed that IGM positively affects the level of managers' JS (H1) which is in line with the finding reported by Qureshi and Mehraj (2022). Namely, it has been confirmed that IGM affects managers' JS in medium-sized and large agribusiness organizations, similar to the effect of IGM on employees' JS in the consumer, industrial and service industries (Qureshi, Mehraj, 2022). This result is supported by the

fact that the internal marketing practice leads to satisfied employees (Ahmed, Rafiq, 2003), since previous studies on the relationship between IGM and JS are rare, while such studies in the agribusiness sector are lacking. Therefore, this result fills the gap in the relevant literature regarding the relationship between IGM and JS, and emphasizes the importance of examining the role of IGM in improving JS and other job-related attitudes.

Managers in Serbian agribusiness sector organizations that adopted the IGM concept developed a positive job-related attitude, that is, they are satisfied with their job. Managers reciprocated to their organizations by demonstrating a higher level of JS since their organizations supported them with IGM activities. In order to encourage managers' JS, these organizations make efforts in the internal green communication (IGC) activities, the green training and education programs (GSD), and the green rewards programs (GRs). As a result, satisfied managers enjoy their jobs more, and stay with their organizations longer. Then they are more satisfied with the job itself, freedom in the workplace, the activities that the work offers, opportunities to interact with others, etc. Relying on this finding and the theory of internal marketing (Ahmed, Rafiq, 2003), it is expected that a higher level of managers' JS will influence a higher level of employees' JS in the IGM environment of Serbian agribusiness sector organizations. Having in mind the above, it is advisable to constantly increase managers' JS (in this case of the agribusiness sector organizations), which can be achieved by paying more attention to the IGM practice.

The second result showed that managers' JS contributes to the improvement of FOs of Serbian agribusiness organizations (H2). The result is consistent with the view of some researchers on the relationship between JS, job performance and organizational performance (Chen et al., 2015 and Shabbir, Salaria, 2014 as cited in Huang et al., 2019), since according to the authors' knowledge, there are no previous studies have tested the relationship between JS and organizational FOs in the IGM environment. The confirmed relationship between these variables in this research is based on the principles of internal marketing theory (Ahmed, Rafiq, 2003). Namely, a higher level of JS makes managers more motivated to perform better, to achieve better job performance, which can ultimately contribute to achieving better FOs. In line with that, this result fills the gap in the relevant literature regarding the relationship between JS and organizational FOs, and highlights the importance of JS in improving FOs and other organizational performance.

When Serbian agribusiness organizations pay attention to managers' JS, they achieve better FOs. In order to encourage sales growth, profitability, cost reduction, pre-tax profit growth, and market share growth, these organizations make efforts to improve managers' JS, as well as all facets of their job. It is expected that the achieved FOs of Serbian agribusiness organizations will affect the improvement of the overall organizational performance. Having in mind the above, one of the ways to improve organizational FOs (in this case in the agribusiness sector organizations) is to understand the importance of managers' JS, since the results in this paper revealed that the effect of managers' JS on organizational FOs was large ($f2 = 0.508$).

The third result of this paper confirmed the indirect effect of IGM on organizational FOs through managers' JS (H3a). The mediating role of managers' JS in this research is partial (both direct and indirect effects were shown to be positive and statistically significant). To date, the examination of this relationship in the context of IGM, as well as in the agribusiness sector, has not been carried out.

Managers supported by IGM activities are more satisfied, and then they are more motivated to perform better, to achieve better job performance and, finally, to contribute more to FOs. This result fills the gap in the relevant literature regarding the mediating role of job-related attitudes (e.g. JS) in the relationship between IGM and FOs. It highlights the importance of examining IGM programs and activities that effectively improve managers' JS and other job-related attitudes, since satisfied managers become more willing to perform better and contribute more to FOs and other organizational performances (environmental performance, as well).

The agribusiness organizations and their managers should be aware of the advantages of the adopting and implementing IGM and its potential in improving JS and then FOs. In order to encourage their managers to be more engaged in achieving FOs, Serbian agribusiness organizations should measure and monitor managers' JS and motivate them to perform better in the interest of their organization.

The fourth result confirmed the direct effect of IGM on FOs of Serbian agribusiness organizations (H3b). This result is in line with the results of previous studies, although Elshaer et al. (2024) tested the direct effect of IGMO on business performance, while Metta (2024, p. 5) suggests that organizations that "possess a strong internal green marketing orientation see an upward trend in terms of market share" (as one of the indicator of FOs). However, a recent study has shown that the direct relationship between these variables in Serbian agribusiness organizations has not been confirmed (Milanović et al., 2022). The authors of this paper assume that some of the reasons may be that the testing of the relationship between IGM and financial performance was conducted on a modest sample of small, medium and large organizations, and that financial performance was observed through three indicators (sales, costs, profit). However, relying on this finding and the facts in the IGMO theory (Papadas et al., 2017), it is expected that IGM will affect FOs of Serbian agribusiness organizations. Having in mind the above, the implementation of the IGM in these organizations becomes significant. IGM can contribute to the achievement of FOs, because its effect on FOs is significant, although small (f2=0.124). In line with that, this result fills the gap in the relevant literature regarding the relationship between IGM and organizational FOs, and highlights the importance of IGM practice in improving FOs and other organizational performance.

Finally, in addition to the mentioned effects of IGM that confirmed in this paper, IGM is expected to contribute to the implementation of the strategic dimension of GMO, having in mind the fact that "the effective implementation of strategic green marketing activity appears to depend upon the support of internal green marketing actions" (Papadas et al., 2017, p. 244).

Conclusion

Achieving a high level of satisfaction of all the organization's stakeholders, on the one hand, and high organizational performance (financial and non-financial performance), on the other, is a challenge faced by organizations, and the one which is not easy to overcome. Effective overcoming of the mentioned challenge is achieved by the organizations whose employees are *customer-* and *environment-oriented*. It is assumed that these organizations take advantage of IGM. Therefore, this paper examined the relationships between IGM, managers' JS, and organizational FOs in Serbian agribusiness sector organizations. The main contribution of this paper is the establishment of the relationships between these variables, as well as the testing of the assumed relationships in the agribusiness sector context in which the relationships between these variables have not been tested before.

The results of this paper showed that there is a positive and statistically significant direct effect of IGM on managers' JS and organizational FOs, as well as a positive and statistically significant direct effect of managers' JS on organizational FOs. They also showed that there is a positive and statistically significant indirect effect of IGM on organizational FOs through managers' JS. The results emphasize the relevance of adopting and implementing the IGM concept in the agribusiness sector, especially in its medium-sized and large organizations. In addition, these organizations should pay attention to managers' JS.

This paper enhances the knowledge on IGM and its effects on managers' JS as one of job-related attitudes, as well as on organizational FOs as one of the organizational success indicators. These results are significant for researchers in the field of internal (green) marketing, (financial) management, organizational behavior, and human resource management. They contribute to the understanding of the impact of IGM as a new marketing practice on JS and FOs. To date, the relationship between the above-mentioned variables in the agribusiness context has not been tested. For managers of the agribusiness organizations, the results of this paper provide insights into how to use IGM to improve JS, and thereby organizational FOs. This provides them an insight into IGM-driven JS and FOs.

The fact that the results of this paper refer to medium-sized and large organizations operating in the Serbian agribusiness sector may limit the generalization of their results. However, the authors of this paper believe that the IGM implementation is more likely in medium-sized and large organizations. In addition, the responses of the managers in this research may be biased, although it is important how they assess the level of IGM implementation in their organizations, what their attitudes are about IGM as an internal green practice and its effects on job-related attitudes and financial performance. Perhaps a longitudinal type of study could be conducted in order to assess the effects of the IGM program on managers' and employees' job-related attitudes as well as financial performance.

Acknowledgements

Conflict of interests

The authors declare no conflict of interest.

References

1. Ahmed, P. K., & Rafiq, M. (2003). Internal marketing issues and challenges. European *Journal of Marketing*, *37*(9), 1177-1186. https://doi.org/10.1108/03090560310498813
2. Becker, J. M., Klein, K., & Wetzels, M. (2012). Hierarchical latent variable models in PLS-SEM: guidelines for using reflective-formative type models. *Long Range Planning*, *45*(5-6), pp. 359-394
3. Bailey, A. A., Albassami, F. & Al-Meshal, S. (2016). The Roles of Employee Job Satisfaction and Organizational Commitment in the Internal Marketing-Employee Bank Identification Relationship. *International Journal of Bank Marketing*, *34*(6), 821-840. https://doi.org/10.1108/IJBM-06-2015-0097
4. Chahal, H., Dangwal, R., & Raina, S. (2014) Conceptualisation, Development and Validation of Green Marketing Orientation (GMO) of SMEs in India: A Case of Electric Sector. *Journal of Global Responsibility*, *5*(2), 312–337. https://doi.org/10.1108/JGR-02-2014-0005
5. Churchill, Jr, G. A. (1979). A Paradigm for Developing Better Measures of Marketing Constructs. *Journal of Marketing Research*, *16*(1), 64-73.
6. Cohen, J. (1988).*Statistical Power Analysis for the Behavioral Sciences,* 2nd ed. New York: Routledge.
7. Crittenden, V. L., Crittenden, W. F., Ferrell, L. K., Ferrell, O. C., & Pinney, C. C. (2011). Market-oriented Sustainability: A Conceptual Framework and Propositions. *Journal of the Academy of Marketing Science*, 39(1), 71-85. doi:10.1007/S11747-010-0217-2
8. Diamantopoulos, A., Sarstedt, M., Fuchs, C., Wilczynski, P., & Kaiser, S. (2012). Guidelines for Choosing Between Multi-Item and Single-Item Scales for Construct Measurement: A Predictive Validity Perspective. *Journal of the Academy of Marketing Science*, *40*(3), 434-449. doi: 10.1007/s11747-011-0300-3
9. Elshaer, I. A., Azazz, A. M. S., Alshebami, A. S., Abdulaziz, T. A., Mansour, M. A., & Fayyad, S. (2024). Internal green marketing orientation and business performance: The role of employee environmental commitment and green organizational identity. *International Journal of Innovative Research and Scientific Studies*, *7*(1), 211-225.
10. Falk, R. F., & Miller, N. B. (1992). *A Primer for Soft Modeling*. University of Akron Press.

11. Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, *18*(1), 39-50. https://doi.org/10.2307/3151312
12. Fraj, E., Martínez, E., & Matute, J. (2011). Green Marketing Strategy and the Firm's Performance: the Moderating Role of Environmental Culture. *Journal of Strategic Marketing*, *19*(4), 339–355. https://doi.org/10.1080/0965254X.2011.581382
13. Freire, C., & Pieta, P. (2022). The Impact of Green Human Resource Management on Organizational Citizenship Behaviors: The Mediating Role of Organizational Identification and Job Satisfaction. *Sustainability*, *14*(13): 7557. https://doi.org/10.3390/su14137557
14. Geisser, S. (1974). A predictive approach to the random effect model. *Biometrika*, *61*(1), 101-107. https://doi.org/10.2307/2334290
15. Gross, H. P., & Rottler, M. (2019). Nonprofits' Internal Marketing and its Influence on Volunteers' Experiences and Behavior: A Multiple Mediation Analysis. *Nonprofit and Voluntary Sector Quarterly*, *48*(2), 388–416. https://doi.org/10.1177/0899764018815614
16. Hair, Jr, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate Data Analysis* (7th ed.) Pearson Education Limited, Edinburgh Gate. Harlow.
17. Hair Jr, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2017). *A Primer on Partial Least Squares Structural Equation Modeling* (2nd ed.). Sage Publications.
18. Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, *31*(1), 2-24. https://doi.org/10.1108/EBR-11-2018-0203
19. Henseler, J., Ringle, C.M., & Sarstedt, M. (2015). A New Criterion for Assessing Discriminant Validity in Variance-based Structural Equation Modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115-135. doi: 10.1007/s11747-014-0403-8
20. Huang, Y. T., Rundle-Thiele, S., & Chen, Y. H. (2019). Extending understanding of the internal marketing practice and employee satisfaction relationship: a budget Chinese airline empirical examination. *Journal of Vacation Marketing*, *25*(1), 88-98, doi: 10.1177/1356766718757270.
21. Judge, T. A., & Klinger, R. (2008). Job Satisfaction. Subjective Well-Being at Work. In: Eid, M., & Larsen, R. J. (Eds). *The science of subjective well-being* (393-413). USA: The Guilford Press
22. Lee, R. P., & Wei, S. (2023). Do employee orientation and societal orientation matter in the customer orientation-Performance link? *Journal of Business Research*, *159*, 113722.

23. Milanović, V., Bučalina Matić, A., Jurčić, A., & Miletić, V. (2022). The impact of internal green marketing on managers' organizational identification and financial performance of organizations of the agribusiness sector in Serbia. *Economics of Agriculture*, *69*(4), 1079-1092. doi: https://doi.org/10.5937/ekoPolj2204079M

24. Metta, S. (2024). Effect of environmental marketing on change in market share: moderated mediation of internal green marketing orientation and strategic green marketing orientation. *EPRA International Journal of Economics, Business and Management Studies (EBMS)*, *11*(1), 5-12.

25. Papadas, K. K., Avlonitis, G. J., & Carrigan, M. (2017). Green Marketing Orientation: Conceptualization, Scale Development and Validation. *Journal of Business Research*, *80*(November), 236-246. https://dx.doi.org/10.1016/j.jbusres.2017.05.024

26. Papadas, K. K., Avlonitis, G. J., Carrigan, M., & Piha, L. (2019). The Interplay of Strategic and Internal Green Marketing Orientation on Competitive Advantage. *Journal of Business Research*, *104*(November), 632-643. https://doi.org/10.1016/j.jbusres.2018.07.00

27. Preduzeća po veličini i preduzetnici u Republici Srbiji 2019–2021 (2023). Republički zavod za statistiku, Beograd [Enterprises by size and entrepreneurs in the Republic of Serbia 2019–2021 (2023). Statistical Office of the Republic of Serbia, Belgrade].

28. Qureshi, I. H., & Mehraj, D. (2022). Identifying the Factors of Internal Green Marketing: A Scale Development and Psychometric Evaluation Approach. *International Journal of Manpower*, *43*(3), 786-804. https://doi.org/10.1108/IJM-06-2020-027

29. Sarstedt, M., Hair Jr, J. F., Cheah, J. H., Becker, J. M., & Ringle, C. M. (2019). How to specify, estimate, and validate higher-order constructs in PLS-SEM. *Australasian Marketing Journal*, *27*(3), 197-211. https://doi.org/10.1016/j.ausmj.2019.05.003

30. Shababi, H., & Golestani, S. (2022). The Effect of Strategic and Internal Green Marketing on Competitive Advantage and organizational Performance (Case Study: Branches of Melli Bank of Mazandaran Province of Iran). *International Journal of Resistive Economics*, *10*(3), 17-26

31. Shmueli, G., & Koppius, O. R. (2011). Predictive Analytics in Information Systems Research. *MIS Quarterly*, *35*(3), 553-572. https://doi.org/10.2307/23042796

32. Stone, M. (1974). Cross-validation and multinomial prediction. *Biometrika*, *61*(3), 509-515. https://doi.org/10.2307/2334733

33. Analiza perspektivnih zanimanja u sektoru agrobiznisa, Fondacija za razvoj ekonomske nauke [The Analysis of Prospective Occupations in the Agribusiness sector, Foundation for the Advancement of Economics], Retrieved from http://noks.mpn.gov.rs/wp-content/uploads/2017/07/Analiza-perspektivnih-zanimanja-u-sektoru-agrobiznisa.pdf (November 9, 2023]
34. All companies in Serbia, Retrieved from https://kompanije.co.rs (November 9, 2023)
35. Best of Serbia, Retrieved from https://www.bestofserbia.rs (November 7, 2023)
36. Poljosfera [Agriculture sphere], Retrieved from https://www.poljosfera.rs/agrosfera/adresar/ (October 30, 2023]

AN ASSESSMENT OF THE SOCIO-ECONOMIC IMPACT OF WATER ACCESS FOR ROMA AND OTHER MARGINALIZED GROUPS IN RURAL SERBIA

Lara Lebedinski[1], *Mihajlo Djukic*[2], *Dejana Pavlovic*[3]

**Corresponding author E-mail: dejana.pavlovic@ien.bg.ac.rs*

ARTICLE INFO

Original Article

Received: *03 November 2024*

Accepted: *15 December 2024*

doi:10.59267/ekoPolj2501123L

UDC 628.1:316.722(=214.58)(497.11)

Keywords:

Socioeconomic development, water access, marginal groups, Serbia

***JEL**: Q25, Q15, J22, O22*

ABSTRACT

This paper uses survey data aiming to assess the socio-economic impacts of providing water supply access to selected group of low-income communities in rural Serbia. Employing a mixed-methods approach, we have collected quantitative and qualitative data from beneficiaries of the water supply program to evaluate changes in quality of life, hygiene, nutrition, and new opportunities arising from reduced time spent on water collection. Results indicate that 94.6% of participants reported improvements in their quality of life, with an average satisfaction score of 8.8. Key benefits included enhanced hygiene and increased time for education and income-generating activities, though non-returnees exhibited higher satisfaction levels compared to returnees, highlighting persistent challenges for the latter group. The paper concludes that integrated strategies are essential to address both water access and broader socio-economic challenges. Recommendations for policymakers include the development of targeted interventions to improve infrastructure and support initiatives that facilitate employment and education.

Introduction

Recognizing the critical role of clean water securing health and well-being, access to water is a universal human right enshrined in the UN Sustainable Development Agenda which provides "universal access to safe drinking water and sanitation by 2030" as its Sustainable Development Goal (UN, 2016). Domestically available running water and

1 Lara Lebedinski, Researcher, University of Vienna, Rooseveltplatz 2, 1090 Vienna, Austria Phone: +4368110237334, E-mail: lara.lebedinski@univie.ac.at, ORCID ID (https://orcid.org/0000-0002-7236-3519)

2 Mihajlo Djukic, Senior Research Associate, Institute of economic sciences, Zmaj Jovina 12, 11000 Belgrade, Serbia, Phone: +381112623055, E-mail: mihajlo.djukic@ien.bg.ac.rs, ORCID ID (https://orcid.org/0000-0001-5677-330X)

3 Dejana Pavlovic, Research associate, Institute of economic sciences, Zmaj Jovina 12 11000 Belgrade, Serbia, Phone: +381112623055, E-mail: dejana.pavlovic@ien.bg.ac.rs, ORCID ID (https://orcid.org/0000-0001-5090-302X)

sewage-system access are a necessity to maintain public health as even low-income settlements relying on communal taps or standpipes to access potable water often face higher rates of water contamination and infection by communicable diseases (Enqvist et al., 2020). Moreover, while scarcity of access to clean, potable water may not only lead to negative health outcomes and worsen quality of life, it bears wider socio-economic impacts such as reduction of disposable income or deteriorating education outcomes as well that are often overlooked and inadequately considered when drafting policy and conducting research (Adom et al. 2023).

Insufficient access to water exacerbates existing inequalities, disproportionately affecting marginalized communities, which widens economic disparity (Israilova et al., 2023). Inadequate or no access to public water infrastructure necessitates time spent fetching and planning ahead to secure daily water needs creating a *Bastiat* conundrum of expending time and resources for daily necessities which creates lost-cost opportunities for the communities it affects. As the time spent on water and the inability to secure hygienic environments cause a higher expenditure of time and labor that might be dedicated to other areas of life (SIWI, 2005), impoverishment of basic daily necessities such as water may be a fundamental pillar undermining other efforts to help communities in other economic or socio-areas (Ranganathan, Balazs, 2015).

Water is not only essential for human consumption but is also a key resource for numerous economic sectors, including agriculture, energy production and tourism. The inextricable link between sustainable water management and economic development is well recognized: studies have shown a causal link between access to water and economic growth. For instance, low-income countries that have wider running-water access see a higher average GDP growth of 3.7%, while countries with power access experience an average growth of only 0.1% (SIWI, 2005). Inadequate water supply may also hamper local or domestic food production, with inadequate supply being a correlating factor to food scarcity (Mancosu et al., 2015). Unfortunately, communities might actively compete with industry and agriculture for water access and use. Wescoat et al. (2007) have corroborated the link between poverty and water access in the US, particularly for low-income households located in suburban or remote rural areas.

Throughout Europe, access to safe drinking water and sanitation services is fundamental to securing the health of a community. Unfortunately, marginalized communities still have inadequate access to clean water and sewage systems. In short, water, sanitation, and electricity, whose absence has a cascading effect on daily life, are the three components essential to quality housing. Therefore, ensuring "the availability and sustainable management of water and sanitation for all", as well as the "access to affordable, reliable, sustainable and modern energy for all" are goals 6 and 7 of the UN's Sustainable Development Agenda (UN, 2016). Clean and plentiful water, effective sanitation, domestic and personal hygiene, and urban design are all necessary for a healthy population (Brown et al, 2023). However, 'fringe' urban communities fall at the mercy of local municipal governments and administration to provide necessary services, creating a continuing cycle of marginalization.

Significant variations in time spent fetching water may greatly affect individual professional development which may then further negatively affect economic potential. Evidence highly suggests that investing in water management and services is able to significantly boost economic growth in developing countries. By reducing associated water-borne illness and the time necessary to fetch water, time may be reinvested into other activities, especially for education among youth. Countering the ill-effects to such diseases also contributes to improved cognitive abilities, underpinning further downstream effects of increased education abilities and economic performance (Michaelowa, 2000).

Limited access to infrastructure increases the burden of uncompensated work, which disproportionately affects women and limits their availability for childcare and educational activities. Research dealing with the supplying of households with their daily water needs particularly underscores the significant impact of unpaid work carried out by mothers in rural areas, which has a direct effect on the general well-being of their children. Children from households that are not forced to collect wood and water show significantly better educational performance, with girls and boys adversely affected in terms of their education (Chaudhuri, Desai, 2021). Therein lies the other core issue that, when not done by the mother, fetching water may primarily fall on children. While the chore may be perceived as beneficial, providing physical activity or even financial remuneration, there are severe associated risks, including increased exposure to environmental hazards and physical strain. Given children's greater vulnerability and limited physical strength, as well as comparatively poorer judgment skills, relying on them to secure adequate water supplies for daily household needs raises serious concerns (Geere, Cortobius, 2017).

Furthermore, the issue of water supply also necessitates the expenditure of physical labor to transport water from public sources, involving carrying containers and storing them within one's home or domicile – the process of which may negatively affect water quality (Baguma et al., 2013). Therefore, the need to access water in public puts the elderly, orphans, the ill, the disabled or those facing social stigma at a disadvantage, making them especially vulnerable to household water insecurity (Wrisdale et al, 2017).

Among all marginalized communities in Europe, the Roma are the most impacted by poor water and sewage access. While they are still more likely to have poorer access to healthcare, education and ready employment, their primary lack water and sanitation access persists despite a range of initiatives undertaken to correct such disparities (Parekh, Rose, 2011). Exacerbating circumstances are the informal settlements in which the majority of Roma in Europe may live (Rosa, 2019; Chaudhuri, 2017; Filčák et al., 2018). As Roma settlements are generally located peripherally to major urban centers and frequently separated from main road access, there placement contributes to higher costs and logistical challenges in securing basic utilities. Living in *de facto* segregated communities isolated majority population, the majority of such settlements are close to industrial zones, waste disposal sites or agricultural cooperatives, which polluted the open water they use which is further cross-contaminated by the presence of

human and animal feces in rainy seasons and spreads waterborne diseases (typhus and diphtheria, among others) (Filcak et al., 2018). Indeed, the higher incidence of these diseases within the Roma community as whole reflects their poor access to water and sewage (Chaudhuri, 2017; Parekh and Rose, 2011). A further hindrance is that Roma communities are characterized by their distinct lack of physical infrastructure, socially in terms of housing, thereby making them difficult to hook up to existing sewage and waterlines (Filcak et al., 2018).

The issue facing access by the Roma community to safe and clean water as well as sanitation is not for a lack of political will. The EU and its Member States have acknowledged the dire need to improve daily living conditions among the Roma population living within their borders. Although it did not fully achieve its goals, the "Decade of Roma Inclusion" (2005) was initially declared in response to improving discrepancies in welfare, housing and exclusion (Brüggemann, Friedman, 2017). In 2011, the European Commission established the EU Framework for National Roma Integration Strategies, urging effective inclusion policies by 2020, public utilities and urban regeneration (European Commission, 2019). Furthermore, the "Roma Integration 2020" initiative aimed to address gaps in housing and utility access, particularly for EU accession candidates (Regional Cooperation Council, 2016). The 2018 proposal for the Drinking Water Directive further emphasized improving water access for all marginalized groups, including Roma (European Commission, 2018).

Despite these many efforts, numerous Roma households face nearly insurmountable barriers to accessing water and sanitation services. Reports indicate that access to safe and clean, domestically piped water is significantly lower among Roma with discrimination worsening such disparities (UNDP, 2018). To illustrate, only 14% of Roma communities in Slovakia are connected to public water access, while 49% are not connected to any public sewage system (Atlas of Roma Communities, 2019). Although the percentage of Roma households that are not connected to tap water has decreased from 30% in 2016 to 22% in 2021, the discrepancy between this access is till 15 times higher compared to the EU population in general (1.5%) (FRA, 2022).

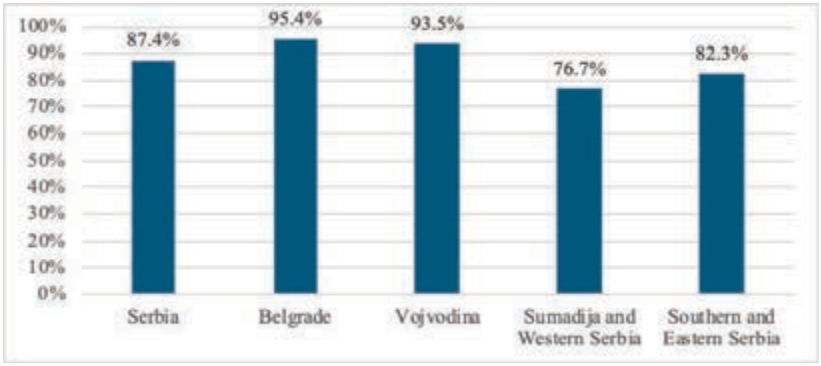
In addition to the Roma population, there is another vulnerable population group, namely returnees, who face major challenges when returning to their home country, especially if they are forced to return. According to many studies, irregular returnees have difficulties integrating socially and culturally compared to non-migrants or other returnees (Beauchemin et al., 2022; Anda, 2017). While the return of irregular migrants has been one of the critical elements of EU immigration policy since the early 2000s, it has been on the political agenda in Serbia since the start of negotiations with the EU on visa liberalization for Serbian citizens in 2007. As stated by GIZ (2022), the majority of returnee's face problems such as low education levels and school dropout, high unemployment and poor quality of employment, low income and poor housing conditions, while almost half of them live with more than two problems such as lack of space, humidity, a leaky roof or lack of daylight.

From a methodological and analytical standpoint, beyond the concern of a lack of comprehensive studies on water and sewage access is also a standing issue within the literature (Ezbakhe et. al. ,2019). Insufficient comprehensive statistics and standardized definitions of "vulnerability" create a challenging environment in which to assess water. Disparate contexts necessitate nuanced evaluation, as not all marginalized groups face the same systemic issues (Lerisse et al., 2003).

Context and Background: Water Access in Serbia and Other Countries

Although the majority of individual households in Serbia have access to public water and sewage, there is still a significant proportion not connected. According to the latest available official data, 12.6% of Serbia's more than 2.5 million households are not connected to the water supply (SORS, 2024); even for those connected, many located in the underdeveloped rural areas do not have continuous and reliable access to clean water (Figure 1). Compared to the region of Vojvodina where almost all households are connected to running water, almost one in four households in Sumadija and Western Serbia, and almost one in five in Eastern and Southern parts of the country are not connected. Migration into the public system is marred in these areas by the rapidly aging local population and persistent poverty (Bobic et al., 2016). Households not connected to public water must fetch their own water through wells or other uncertain access points which takes up considerable time, energy and resources that could be applied to other more pressing issues.

Figure 1. Share of households in Serbia with access to public water infrastructure in 2023



Source: Authors' calculations

Despite the many existing evaluations of the infrastructure projects in Serbia that address effectiveness, they largely do not examine the marginal effects on the socio-economic background of their participants. In response, this study tries to address this gap by analyzing the socio-economic impact of water supply and access to not only the Roma but other marginalized groups throughout Serbia as based on the self-reports of beneficiaries whose objective was to improve general access to water infrastructure.

According to the SDG Report (2022), the proportion of the world's population using

safely managed drinking water systems increased from 70% in 2015 to 74% in 2020. However, around 2 billion people still did not have access to these basic services that year, including 1.2 billion people who did not even receive a basic service. It is particularly notable that eight out of ten people without access to basic drinking water services live in rural areas, with around half of this population living in the least developed countries.

Some high-income countries also face this problem. In France, where over 99% of the population is reported to have piped water at home, 77% of informal Roma settlements have no access to drinking water (Brown et al, 2023). Three interlinked trends are critical to understanding why safe and effective water and sanitation services remain inaccessible for many people in high-income countries. First, systemic racism drives persistent inequality in societies, limiting access to resources and perpetuating social exclusion and poverty. Second, changes in infrastructure funding models have led to a reduction in subsidies that could otherwise be made available to those in need. Thirdly, inequalities persist because the availability and quality of services are often linked to housing and property ownership.

Access to piped water has improved significantly for the Roma population over time. While the proportion of Roma households without piped water has decreased from 30% in 2016 to 22% in 2021, this figure is still more than 15 times higher than that of the general EU population, which is only 1.5%. The highest rates of Roma without piped water are in Romania (40%) and Slovakia (28%). In Romania, a significant proportion of the general population (21%) is also affected by the lack of tap water, narrowing the gap between Roma and non-Roma. As with other housing indicators, there are no significant differences by gender or age. However, Roma children under the age of 15 are more likely to live in households without tap water than their older counterparts. Furthermore, Roma with severe health limitations in daily activities are disproportionately affected: 28% have no access to tap water compared to 18% of those without such limitations in Romania. This inequality is particularly marked in North Macedonia and Romania compared to other countries (FRA, 2022).

Bearing this in mind, this paper aims to identify current state with regards to water access of the marginalized households facing insufficiencies in water supply to arrive at an outcome applicable to real-world application in delivering better water access to marginalized communities. Additionally, by assessing the effectiveness of the provided water access support, the research aimed at detecting the most significant benefits of the reduced time that was spent for fetching the water as well as the indirect impacts that water access might have on the labor and education outcomes.

Following the introductory part and the current section which provided a statistical overview of the water access in Serbia and other countries and analysis of the research context, the third section summarizes the methodological approach taken, the data collection methods and the characteristics of the sample. The results obtained are presented in the fourth section, along with a discussion of the results in comparison to

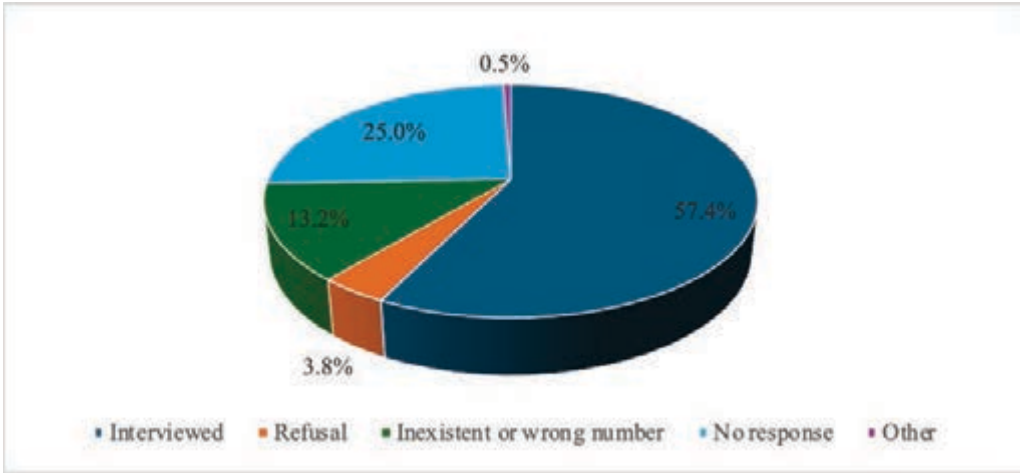
similar such projects. The final section provides recommendations for policy makers applicable to designingsimilar projects in the future.

Data and Methodology

This research is based on a program designed to provide access to water supply to selected low-income individuals to address basic socio-economic challenges exacerbated by the COVID-19 pandemic. The sampling frame included the entire population of beneficiaries participating in the program. Data collection took place in two waves: The first wave covered participants who took part from the start of the program in 2018 until June 2021, while the second wave included those who took part from 2018 until the end of 2022. The sample was analyzed according to key characteristics such as group affiliation, gender and returnee status. In total, 316 out of 551 participants were interviewed, representing 57.4% of the total sample (*Figure 2*).

Of the total 316 interviews conducted, 47.8% are women, 73.6% belong to Roma population, and 14.2% stated that they are returnees, meaning that they returned to Serbia after spending at least three months abroad. They are all considered low-income population, while a considerable part of the interviewees had difficulties in meeting basic needs (e.g. lack of bathroom or toilet).

Figure 2. Survey response rate in %



Source: Authors' calculations

**Total number of contacted persons (n) = 551*

Table 1. Socio-economic characteristics of participants

Female	**47.8%**
Returnee	14.2%
Number females in household	2.9
Number males in household	3.2
Number of children in household	1.6
Roma	73.7%
Internally displaced person	2.2%
Has well	44.9%
Brings water from others	32.0%
Bath or toilet in house	53.2%

Source: Authors' calculations

**Total sample (n) = 316 participants*

*** One member per participating household was interviewed. As all 1,976 household members are considered to have benefited from the measure, we set the number of beneficiaries to be equal to the number of household members in households receiving the measure.*

A phone survey was conducted to gather information on participants' satisfaction, experiences and other attitudes related to program implementation. Participants were asked a series of questions about their experiences with the program. The questionnaire referred to the household level, the data was weighted according to the number of household members and the analysis was conducted at the individual level.

The questionnaire consisted of 11 questions. The first section contained questions assessing household access to water prior to the implementation of the program. In order to assess the differences in outcomes between participants with different migration histories (returnees vs. non-returnees) and to consider the gender perspective, this section included questions asking participants to indicate their migration history and gender. In the second section, participants were asked to provide information on their general socioeconomic situation and to express their opinion on the improvement of their socioeconomic situation as a result of participating in the program. The third section contained questions about their overall satisfaction with participation in the program. The main research questions are as follows:

- How has access to water improved household living conditions and habits (e.g., hygiene, nutrition, washing clothes, etc.)?
- What is the perception of the interviewees with regard to socio-economic improvement of the household that could be attributed to the specific intervention and general satisfaction with the programme?
- What are the remaining challenges in water access, and how are they distributed across different demographic groups (e.g., returnees)?

Results and discussion

The main objective of the research is to assess whether the socio-economic situation of participants has improved as a result of the program. For the purposes of this analysis, an improvement in socio-economic status is defined as a respondent providing a score of 2 or higher on a scale of 1 to 10. As shown in the *Table 2* below, the program has been positively assessed by the vast majority of interviewed participants. Around 94.6% of participants indicated that program has contributed to improvement of the household's socioeconomic situation. The average rating of the program is 8.8, whereas minor differences between returnees and non-returnees could be identified. Non-returnees had slightly better perception of the program effectiveness if compared to returnees since 96.5% of them considered the program has positively affected their socio-economic situation in comparison with 82% of the returnees.

Table 2. Improvement of socio-economic situation as a result of the program in % and reported score (1 to 10 ratings)

	Total	**Returnee**	**Non-returnee**	**Diff.**
Improved socio-economic situation % (N=296)	94.6	82.0	96.5	*
Improved socio-economic situation (N=296)	8.8	8.3	8.9	***

Source: Authors' calculations

Before gaining access to water through the program, 44.4% of participants relied on wells, 27.2% obtained water from the public supply, 12.3% obtained water from neighbors, friends, or family, and 16.7% had access to a spring (*Table 3*). Responsibility for fetching water was relatively evenly split between male and female non-returnees. Among returnees, however, it was predominantly men who took responsibility for fetching water. In addition, 30.3% of participants already had access to water, meaning that no one in their household was responsible for fetching water.

Access to water brought numerous benefits for the participants. The quality of life of the program participants improved considerably, especially in the areas of hygiene and nutrition. The economic impact of the program was reflected in lower costs and more time for leisure, childcare or work. Specifically, 91.0% of respondents reported improved hygiene through access to water, 86.3% found it easier to wash their clothes, 87.5% reported better water quality and 87.0% noted that access to water improved their diet. In addition, 53.6% of participants were able to reduce their costs, while 54.2% reported having more time on their hands. Of those who had more time, 49.9% used it for leisure, 39.0% for childcare, 44.3% for work and 6.7% used the extra time to look for work.

However, there are still significant problems with the quality of the water supply. Despite the benefits of the program, 28.4% of households continue to have problems with access to water. Of those who reported problems, 72.9% reported low water

pressure, 41.8% reported cloudy water and 19.6% were at times without water supply. Participants also pointed out other major infrastructure problems: 74.8% had no sewage system, 42.8% had not yet legalized their houses, 34.6% had problems with electricity supply and 7.0% lacked facilities for people with disabilities. Despite these problems, 85.3% of households were satisfied with the program overall.

Table 3. Impact of the program: Overall and by returnee status

	Total	**Returnee**	**Non-returnee**	**Diff.**
	N=316	N=45	N=271	
Before				
Access water before*				
Brought from public water supply	27.2%	31.3%	26.5%	not.sign.
From neighbors/friends/family	12.3%	24.4%	10.2%	***
Own well	44.4%	33.6%	46.3%	*
Spring	16.7%	0.0%	19.5%	***
Other	6.7%	7.0%	6.7%	not.sign.
Who was responsible for water access?*	100.0%	100.0%	100.0%	
Males (father/son)	22.6%	49.1%	18.3%	***
Females (mother/daughter)	12.5%	8.8%	13.1%	not.sign.
Children	3.1%	22.7%	0.0%	***
Relatives	1.4%	0.0%	1.6%	not.sign.
Everyone	18.9%	28.1%	17.4%	not.sign.
No one	30.3%	5.3%	34.3%	***
After				
Better hygiene	91.0%	90.0%	91.1%	not.sign.
More time available	54.2%	77.9%	51.3%	***
Lower costs	53.6%	60.3%	52.8%	not.sign.
Better quality water	87.5%	63.5%	90.5%	***
Better nutrition	87.0%	84.8%	87.3%	not.sign.
Easier to wash cloths	86.3%	70.2%	88.3%	***
More time available for...*				
More time for children	39.0%	93.6%	28.8%	***

	Total	Returnee	Non-returnee	Diff.
More time for job search	6.7%	0.0%	7.9%	not.sign.
More time for work	44.3%	38.2%	45.4%	not.sign.
More time for leisure	49.9%	100.0%	40.5%	***
Any problem water access	28.4%	24.0%	29.2%	not.sign.
What problem with water*				
There are periods without water	19.6%	0.0%	22.5%	not.sign.
Low pressure	72.9%	70.6%	73.3%	not.sign.
Cloudy water	41.8%	63.3%	38.7%	not.sign.
Other infrastructural problems*				
No sewage	74.8%	59.2%	77.6%	**
Problems with electricity	34.6%	29.2%	35.6%	***
Legalization of object	42.8%	72.7%	37.5%	not.sign.
Access for persons with disabilities	7.0%	27.7%	3.2%	***
Satisfied with program: score	9.6	9.1	9.6	*
Would participate again				not.sign.
Yes	85.3%	87.8%	84.9%	
No	4.7%	12.2%	3.4%	
I don't know	10.0%	0.0%	11.7%	

Source: Authors' calculations

*A p-value lower than 0.1 implies that the difference between two groups is statistically significant at 10%. * significant at 1%, ** significant at 5%, *** significant at 10%.*

Overall, there seem to be some differences between returnees and non-returnees. Before the program, returnees were more likely to get their water from neighbors, friends or family. They were less likely to have their own well or access to a spring. Among returnees, men and children were responsible for fetching water, while among non-returnees this task was shared between adult men and women. Access to water brought greater benefits to returnees compared to non-returnees in the form of more time for children and more time to look for work. Compared to non-returnees, returnees were less likely to say that they still needed support to legalize their property and access to sanitation. Returnees were more likely to state that they needed access for people with disabilities. Overall, non-returnees reported benefiting more from the program than returnees.

Conclusion

While reliable access to safe drinking water and sanitation services remains a crucial concern for marginalized populations across Europe, it is a particular issue facing Roma communities that must deal with difficulties related to both the quality and affordability of water. Although numerous initiatives have been implemented to enhance living conditions among the Roma, significant disparities continue to exist, with Roma residing in improvised settlements that often illustrate socio-spatial marginalization.

By providing empirical evidence on the socio-economic impacts of water supply endeavors in low-income communities in Serbia, particularly in the context of crises such as the COVID-19 pandemic, this paper underscores the importance of addressing both immediate needs and long-term infrastructural challenges to enhance overall life quality.

Our research highlights several key findings of the impact of the water supply program on low-income households. With an average satisfaction score of 8.8, an overwhelming 94.6% of participants reported improvements in their daily socio-economic life. As direct benefits of participating in the program, the majority of the beneficiaries reported improved hygiene, better nutrition and that it was easier to do laundry. Notably, while both returnees and non-returnees benefited from enhanced water access, non-returnees expressed higher overall satisfaction, observing the program to be more effective. Nevertheless, there are ongoing challenges that remain prevalent to water quality issues and infrastructural deficits among returnees that had relied more on neighbors for water access prior to the program.

The research also established there to be a range of diverse benefits stemming from the reduced time spent on fetching water, which contributes to both improved education and labor-market outcomes. When provided with water access adult household members were also provided with more available time to spend with their children. Simultaneously, the children were able to dedicate this time to committing to their education. Prior to the intervention, the role of children in fetching water was quite prominent to the extent that children were exclusively in charge of delivering water in 3.1% of the households, observed and they jointly participated in fetching water along with other household members in 18.9%. After the program, 39% of the beneficiaries interviewed reported spending more time with children as the most important benefit of the program. This finding is noteworthy as the time children spend with their parents is considered to be a leading factor in a child's general wellbeing and mental health. Accordingly, at-home school assignments often require parental supervision which water access provides by free both parent and child from the onerous task. Additionally, better access to water may also lead to an increase in school enrollment rates among poor rural communities experiencing low enrollment.

The increased time available to spend on income-generating activities contributes to the availability of resources and therefore represents an important determinant of the family's wellbeing which may potentially help reduce overall poverty. In this regard, more than 53% of the participants interviewed reported to have lower costs due to their

water access. The results also indicate that 44.3% of the beneficiaries reported more time for other activities, with 6.7% indicating that they have more time to actively seek paid employment. Given this exact result, it would be prudent to consider integrating employment and skills development initiatives alongside infrastructural support measures to maximize impact.

Despite these overall positive impacts, other critical infrastructural challenges faced by the marginalized population in their daily lives were noted in the course of this research, the most pressing of which include: inadequate access to sewage systems; limited access or supply of electricity; and the inability to ensure adequate living conditions for the disabled.

Future research should explore the longitudinal impacts of the water supply program to assess long-term sustainability and changes in socio-economic conditions over time. In addition, investigating the exact barriers faced by returnees compared to non-returnees may cast light on more effective support mechanisms. It is necessary to investigate the broader infrastructural issues that contribute to water quality challenges, which integrate multi-sectorial approaches to address housing, sanitation and economic opportunities in conjunction with water access.

Acknowledgements

This research output was produced as part of the project “Survey for module indicator 2” financed by the German Corporation for International Cooperation (GIZ).

The research presented in this paper was funded by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia under contract number 451-03-66/2024-03/200005.

Conflict of interests

The authors declare no conflict of interest.

References

1. Adom, R. K., Simatele, M. D., & Reid, M. (2023). Assessing the social and economic implications on water security in the Nelson Mandela Bay Metropolitan Municipality, Eastern Cape of South Africa. *Journal of Water and Health*, 21(7), 939-955. https://iwaponline.com/jwh/article/21/7/939/95919/Assessing-the-social-and-economic-implications-on
2. Atlas of Roma Communities (2019), Plenipotentiary Office. Retrieved from https://www.minv.sk/?atlas-romskych-komunit-2019
3. Baguma, D.; Hashim, J.H.; Aljunid, S.M. and Loiskandl, W. (2013). Safe-water shortages, gender perspectives, and related challenges in developing countries: The case of Uganda. *Science of the Total Environment*, 442(C), 96- 102. https://www.sciencedirect.com/science/article/abs/pii/S0048969712012867?via%3Dihub

4. Beauchemin, C., Vandenbunder, A., Mathon Cécillon, T., Goussé-Breton, Z., Dieng, M., & Yahyaoui, M. (2022). Socioeconomic reintegration of return migrants and the varieties of legal status trajectory in Europe. *Population, Space and Place*, 28(7), e2565. https://onlinelibrary.wiley.com/doi/epdf/10.1002/psp.2565

5. Bobic, M., Veskovic Andjelkovic, M., & Kokotovic Kanazir, V. (2016). *Study on External and Internal Migration of Serbia's Citizens.* International Organisation for Migration (IOM). https://serbia.iom.int/sites/g/files/tmzbdl1126/files/documents/Study%20on%20external%20and%20internal%20migration%20of%20Serbia%27s%20citizens%20with%20particular%20focus%20on%20Youth.pdf

6. Brown, J., Acey, C.S., Anthonj, C., Barrington, D.J., Beal, C.D., Capone, D., Cumming, O., Fedinick, K.P., Gibson, J.M., Hicks, B., Kozubik,M., Lakatosova, N., Linden, K.G., Love, N.G. Mattos, K.J., Murphy, H.M., Winkler, I.T. (2023). *The effects of racism, social exclusion, and discrimination on achieving universal safe water and sanitation in high-income countries*, Lancet Glob Health, vol. 11: e606–14.

7. Brüggemann, C. & Friedman, E. (2017). The Decade of Roma Inclusion: Origins, Actors, and Legacies, *European Education,* vol. 49 (1), 1-9. https://doi.org/10.1080/10564934.2017.1290422

8. Chaudhuri, I. N. (2017). Community Mobilization for Slum Upgrading through Sanitation in Roma Informal Settlements in the Paris Region, *Frontiers in Public Health,* 5: 213. doi: 10.3389/fpubh.2017.00213.

9. Chaudhuri, P. & Desai, S. (2021). Lack of access to clean fuel and piped water and children's educational outcomes in rural India, *World Development*, vol. 145, https://doi.org/10.1016/j.worlddev.2021.105535

10. Decade of Roma inclusion (2005). Retrieved from https://adsdatabase.ohchr.org/IssueLibrary/HUNGARY_Decade%20of%20Roma%20Inclusion%202005-2015.pdf

11. Enqvist, J., Ziervogel, G., Metelerkamp, L., et al. (2020). Informality and water justice: Community perspectives on water issues in Cape Town's low-income neighborhoods, *Int J Water Resour Dev*., vol. 1, 108–129. doi: 10.1080/07900627.2020.1841605

12. European Commission (2018). Proposal for a Directive of the European Parliament and of the Council on the quality of water intended for human consumption (2018/C 361/08). Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52018AR0924

13. European Commission (2019). Report on the Implementation of National Roma Integration Strategies—2019. Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52019DC0406

14. Ezbakhe, F., Giné-Garriga, R., Pérez-Foguet, A. (2019). Leaving no one behind:Evaluating access to water, sanitation and hygiene for vulnerable andmarginalized groups, *Science of the Total Environment*, 683, 537-546. https://doi.org/10.1016/j.scitotenv.2019.05.207

15. Filcak, R., Szilvasi, M., & Škobla, D. (2018). No Water for the Poor: The Roma Ethnic Minority and Local Governance in Slovakia, *Ethnic and Racial Studies* 41: 1390–407.
16. FRA- European Union Agency for Fundamental Rights (2022). Roma Survey. Retrieved from https://fra.europa.eu/sites/default/files/fra_uploads/fra-2022-roma-survey-2021-main-results2_en.pdf
17. Geere, J.-A. & Cortobius, M. (2017). Who carries the weight of water? Fetching water in rural and urban areas and the implications for water security, *Water Alternatives*, vol. 10(2): 513-540.
18. GIZ (2022). „Društveno-ekonomski položaj i reintegracija povratnika po sporazumu o readmisiji u Srbiji 2021. godine: Izveštaj o istraživanju povratnika i pružalaca usluga na lokalnom nivou", globalni program Migracije za razvoj, Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), Beograd.
19. Israilova, E., Voronina, A., & Shatila, K. (2023). *Impact of water scarcity on socio-economic development*. International Scientific Conference Energy Management of Municipal Facilities and Environmental Technologies (EMMFT-2023), vol. 458, 08027). EDP Sciences. https://doi.org/10.1051/e3sconf/202345808027
20. Lerisse, F., Mmari, D., & Baruani, M. (2003). *Vulnerability and Social Protection Programmes in Tanzania*, Study on Social Protection Programmes on Vulnerability. Retrieved from https://www.repoa.or.tz/wp-content/uploads/2020/07/Vulnerability_and_Social_Protection_-_Sept_2003.pdf
21. Mancosu, N., Snyder, R. L., Kriakakis, G. & Spano, D. (2015). Water Scarcity and Future Challenges for Food Production, *Water*, vol. 7(3), 975-992; https://doi.org/10.3390/w7030975
22. Michaelowa, K. (2000). Returns to education in low income countries: evidence for Africa. In: Conference: *Committee on Developing Countries of the German Economic Association*, Berlin.
23. Parekh N, & Rose T. (2011). Health inequalities of the Roma in Europe: a literature review. *Cent Eur J Public Health*, vol. 19(3), 139-42. doi: 10.21101/cejph.a3661. PMID: 22026288.
24. Parekh, N., & Tamsin, R. (2011). Health Inequalities of the Roma in Europe: A Literature Review, *Central European Journal of Public Health, vol.* 19, 139–142.
25. Ranganathan, M., & Balazs, C. (2015). Water marginalization at the urban fringe: environmental justice and urban political ecology across the North–South divide, *Urban Geography,* vol. 36(3), 403-423. https://www.tandfonline.com/doi/full/10.1080/02723638.2015.1005414#d1e140
26. Regional Cooperation Council (2016). Roma Integration 2020: Project Brief. Belgrade, Serbia. Retrieved from https://www.rcc.int/romaintegration2020/files/admin/docs/0c8d31df7cd0747b3d331c9639843e1b.pdf

27. Rosa, E. (2019). Why Self-Care Matters for Roma People and beyond. Vulnerability and the (Un)Making of Water and Sanitation Infrastructure at the Margins of the City, *Geoforum*, vol.101, 192–201.
28. Statistical Office of the Republic of Serbia (2024). Municipalities and regions of the Republic of Serbia, 2024. Retrieved from https://www.stat.gov.rs/sr-cyrl/publikacije/publication/?p=17065&tip=13
29. Stockholm International Water Institute (SIWI) (2005). Making Water a Part of Economic Development: The Economic Benefits of Improved Water Management and Services. Retrieved from https://www.ircwash.org/resources/making-water-part-economic-development-economic-benefits-improved-water-management-and
30. UN SDG Goals (2016). Retrieved from https://unstats.un.org/sdgs/report/2016/the%20sustainable%20development%20goals%20report%202016.pdf
31. UNDP (2018). Health Deprivation Among Roma. Retrieved from https://www.undp.org/sites/g/files/zskgke326/files/migration/eurasia/HealthDeprivationAmongRoma_UNDP_RBEC.pdf
32. United Nations (UN) Sustainable Development Goals (2022). The Sustainable Development Goals Report 2022. Retrieved from https://unstats.un.org/sdgs/report/2022/
33. Wescoat Jr, J. L., Headington, L., & Theobald, R. (2007). Water and poverty in the United States, *Geoforum,* vol. 38(5), 801-814.
34. Wrisdale, L., Mudau, L.S., Mokoena, M.M., & Geere, J. (2017). Factors that impact on access to water and sanitation for older adults and people with disability in rural South Africa: An occupational justice perspective, *Journal of Occupational Science,* vol. 24(1), 1-21. DOI: 10.1080/14427591.2017.1338190

DETERMINANTS OF DEMAND FOR FRESH VEGETABLES IN THE SLOVAK REPUBLIC

Elena Hoskova[1], Iveta Zentkova[2]

**Corresponding author E-mail: elena.hoskova@uniag.sk*

ARTICLE INFO

Original Article

Received: *08 November 2024*

Accepted: *15 December 2024*

doi:10.59267/ekoPolj2501139H

UDC 366.484.5:635.1/.8(439.22)

Keywords:

Demand function, own-price elasticity, cross-price elasticity, income elasticity, fresh vegetables

***JEL**: D12*

ABSTRACT

Vegetables are among the most important foods because of the health benefits of eating them. The main objective of this paper is to investigate the effect of income, own price and price of other vegetables on the demand for vegetables in the Slovak Republic. Descriptive statistics and regression analysis are used for the analysis. The data are drawn from the Statistical Office of the Slovak Statistical Office (2001-2019). The results of the analyses indicated that demand for lettuce (EID=3.48) and peas (EID=-4.82) responded most strongly to the change in income. The demand response to a change in the price of other vegetables was stronger than the response to a change in own price. Demand for cauliflower, and lettuce responded most strongly to the change in price of other vegetables. To increase vegetable consumption, we recommend reducing the price of complements or increasing the price of substitutes.

Introduction

Food is a key component of several fundamental dimensions of well-being, such as food security, nutrition and health. In low-income countries, they account for the largest share of total household expenditures, on average around 50% of household budgets (Egbetokun & Fraser, 2023). In the Slovak Republic, food expenditures account for approximately 20% of total net expenditures. Food consumption and expenditure on various commodities is an important area of research for economists (Felix & Kumar, 2020). Considering the similarities and differences in household food consumption behaviour, the study of household food consumption pattern is crucial (Hayat et al.,

1 Elena Hošková, Assistant professor, Institute of Economics and Management, Faculty of Economics and Management, Slovak University of Agriculture in Nitra, Tr. A. Hlinku č. 2, 949 76 Nitra, Slovakia, Phone: +4216414575, E-mail: elena.hoskova@uniag.sk, ORCID ID (https://orcid.org/0009-0001-2829-0164)

2 Iveta Zentková, Assistant professor, Institute of Economics and Management, Faculty of Economics and Management, Slovak University of Agriculture in Nitra, Tr. A. Hlinku č. 2, 949 76 Nitra, Slovakia, Phone: +4216414576, E-mail: iveta.zentkova@uniag.sk, ORCID ID (https://orcid.org/0009-0007-0697-9722)

2023). Understanding demand patterns and their underlying determinants is important in designing food policies and informing local suppliers (Lippe et al., 2010).

There has been renewed interest in reliable estimates of food demand elasticities at the disaggregated level, not only to analyse the impact of changing food preferences on the agricultural sector, but also to identify the likely impact of price incentives on households (Ulubsoglu et al., 2016). Households are increasingly price responsive to fresh produce (Lippe et al., 2010). Cross-price and own-price elasticities have become key determinants for policy makers in making decisions on food commodity production (Naheed & Hussain, 2020). In addition to prices, consumer income is also an important determinant of demand. Evidence confirms that consumers respond to prices and income similarly in different countries of the world. Consumers in Pakistan face a different set of constraints than consumers in America. Both supply-side and demand-side factors are at work - access issues are critical, but even with better access, low income and other demand-side issues constrain vegetable consumption (Weatherspoon et al., 2015).

Vegetables play an important role for human health (Deng et al., 2023). It is one of the most important agricultural products in daily life. Due to season, supply and demand, prices fluctuate widely and there are also some substitution linkages between different types of vegetables. The demand for vegetables with strong substitutes is affected by price changes of alternative vegetables (Liu et al., 2019).

Understanding the demand for staple foods, the consumption of which ensures the health of the population, is extremely important. The demand for vegetables is influenced by the income of the population, the intrinsic price of vegetables, and the price of substitutes or complements. Very few studies have analysed the impact of the determinants of demand on the market for individual vegetables. This paper is intended to fill this gap. The main objective of the paper is to investigate the impact of income, own price and price of substitutes or complements on the demand for vegetables in the Slovak Republic. The results of the analyses can be used for nutrition and food policy makers as well as for the public.

Materials and methods

The data for the analysis are drawn from DATACUBE from SUSR, VUEPP and ATIS. The period covered was 2001-2020. The methods used were descriptive statistics and regression analysis.

Input data table

Variable	Unit of measure	Source
Consumption of vegetables	kg. capita^{-1}. year^{-1}	https://www.vuepp.sk/dokumenty/komodity/2021/Ovocie_zelenina_2021_07_v2.pdf https://datacube.statistics.sk/#!/view/sk/vbd_sk_win2/ps1839rs/v_ps1839rs_00_00_00_en
Price of vegetables	EUR. kg^{-1}	https://www.vuepp.sk/dokumenty/komodity/2021/Ovocie_zelenina_2021_07_v2.pdf https://datacube.statistics.sk/#!/view/sk/vbd_sk_win2/ps1839rs/v_ps1839rs_00_00_00_en
Income of habitants	EUR. year^{-1}	https://datacube.statistics.sk/#!/view/sk/vbd_sk_win2/ps1819rs/v_ps1819rs_00_00_00_en

Regression analysis was used to estimate the Marshall demand curve. The Marshall demand curve is a willingness to pay curve derived assuming all prices and incomes are constant (Hudik, 2019). The theoretical basis for the formation of demand functions has been addressed in many studies (Miyake, 2006; Gimenes-Nadal, 2018; Sprouvle, 2013, Pendakur, 2009; Lewbel & Pendakur, 2009; Smith, 2018). The Marshall elasticity compared to the Hicks elasticity provides more accurate pictures of substitutes and complements (Mustafa et al., 2022).

Based on the considerations, Marshall's model of demand for each type of vegetable was specified as a function $Q_{vi} = Q_{vi}(P_x, P_y, I)$. The demand estimator is a linear regression function which has the form:

$$Q_{vi} = \alpha + \beta_1 P_{vi} + \beta_2 I + \beta_n P_{jn} \quad (1)$$

Where:

Q_{vi} – demand for i-th type of vegetable in kg. capita^{-1}. year^{-1}

$\alpha, \beta_1, \beta_2, \beta_n$ – estimated regression parameters

P_{vi} – price of i-th type of vegetable in EUR.kg^{-1}

I- income of inhabitant in EUR.capita^{-1}. year^{-1}

P_{jn} price of j-th type of vegetable in EUR.kg^{-1}

$$E_{ID} = \beta_2 \frac{I}{Q_{vi}} \quad (2)$$

Where:

E_{ID} – income elasticity of demand in %

$$E_{PD} = \beta_1 \frac{P_{vi}}{Q_{vi}} \quad (3)$$

Where:

E_{PD} – own-price elasticity of demand in %

$$E_{CPD} = \beta_n \frac{P_{jn}}{Q_{vi}} \quad (4)$$

Where:

E_{CPD} – cross-price elasticity of demand in %

Results

As part of its disease prevention campaigns, the WHO recommends that people consume 400 g of fruit and vegetables a day. The ratio of vegetables to fruit should be 2:1, i.e. they should consume 270 g of vegetables per day. This equates to 98.55 kg per year. In 2001, the Slovak population consumed 56.2 kg per person per year. In 2019, it was already 73.4. Although the trend of vegetable consumption in Slovakia is increasing, the annual consumption of vegetables is still below the recommendations of experts. Meanwhile, the share of expenditure on vegetables ranged from 6.5 to 9.4% of total net expenditure in the period under review.

Among vegetables, Slovak consumers showed the strongest preference for tomatoes. Their average consumption was 16.17 kg per person per year (standard error 0.49, Table 1). Tomato consumption showed a relatively high standard deviation compared to other vegetables. Their consumption was scattered around the mean by 2.14 kg per person per year. The distribution of consumption is flatter than normal, right sided. Tomato consumption shows a relatively high range of values (Figure 1). The lowest tomato consumption was in 2002 at 11kg per person per year and the highest in 2018 at 18.6kg per person per year. The absolute increase in tomato consumption over the period is positive, Figure 1.

Cabbage was also strongly preferred during the period under review. Its average consumption was 15.85 kg per person per year with a standard deviation of 2.84 kg (Table 1). The distribution was more skewed than normal, left-handed. The trend in the consumption of cabbage in the Slovak Republic is downward, with considerable fluctuations. The absolute increase in cabbage consumption was negative in the period under review (Figure 1). The range of values of cabbage consumption was the highest among all vegetables, namely 12.8 kg. The minimum consumption was 12 kg per person per year in 2011. The highest consumption was at the beginning of the study period, in 2001, at 24.8 kg per person per year.

The average consumption of carrots was 10.73 with a standard deviation of 1.35. The distribution of carrot consumption was flatter than normal, right sided. The trend of carrot consumption was less fluctuating than that of the previous vegetables during the period under review. The trend in consumption was upwards, the absolute increase positive. The range of values was medium, 4.90 kg (Figure 1). The minimum consumption of carrots, 8 kg per person per year, was recorded in 2001. The highest consumption of

carrots by Slovak consumers was in 2019, at 12.8 kg per person per year.

Onion was one of the preferred vegetables among Slovak consumers. Its average consumption was 8.77 kg per person per year in the period under review (Table 1). Onion consumption was in a flatter than normal distribution, left-handed. The trend of its consumption was slightly increasing, with considerable fluctuations. The absolute increase in onion consumption was positive. The standard deviation was among the medium ones. Consumption differed from the average by 1.31 kg in the period under review. The range of values was 4.30 kg (Figure 1). The minimum consumption in 2002 was 7.1 kg per person per year. The highest consumption of onions was recorded in 2013 at 11.4 kg per person per year.

The average consumption of cucumber during the study period was 7.23 kg per person per year with a standard deviation of 1.69 (Table 1). Its distribution was more pointed than normal, right skewed. The range of values was relatively quite high, 6.1 kg (Figure 1). The lowest consumption of cucumbers was in 2002, at 3.5 kg per person. The highest consumption was recorded in 2009, at 9.6 per person. The trend in cucumber consumption was upward, with one significant short-term increase in 2009. The absolute increase in cucumber consumption was positive over the period under review.

The average consumption of peppers was 6.18 kg per person per year with a standard deviation of 1.19 kg during the period under review. The distribution of pepper consumption was flatter than normal, right-sided. Pepper consumption was on an increasing trend over the period with one significant increase in 2006. The range of values was 4.10 (Figure 1). The lowest consumption of pepper per capita per year was 3.6 in 2003 and the highest consumption was 7.7 kg per capita per year in 2016. The absolute increase in consumption over the study period was positive.

Cauliflower had an average consumption of 3.22 during the period under study (Table 1). The standard deviation was 0.58 kg. The distribution was flatter than the normal distribution, right-handed. The range of values was 2.20 kg, the absolute increase in cauliflower consumption was negative over the study period. The lowest consumption of cauliflower in the Slovak Republic was recorded in 2019 at 3.5 kg and the highest in 2008 at 4.5 kg. The trend of cauliflower consumption was slightly decreasing.

Table 1. Results of descriptive analysis of consumption of selected vegetables in kg. capita^{-1}.year^{1}

	Mean	Standard Error	Median	Standard Deviation	Kurtosis	Skewness	Confid. Level (95.0%)
Peas	0.75	0.07	0.80	0.29	-0.73	-0.26	0.14
Celery	1.36	0.12	1.40	0.53	-0.13	0.53	0.26
Carrots	10.73	0.31	11.20	1.35	-0.92	-0.35	0.65
Parsley	2.24	0.09	2.20	0.39	-0.14	0.45	0.19
Onion	8.77	0.30	8.50	1.31	-0.46	0.65	0.63
Tomatoes	16.17	0.49	17.00	2.14	0.76	-1.23	1.3

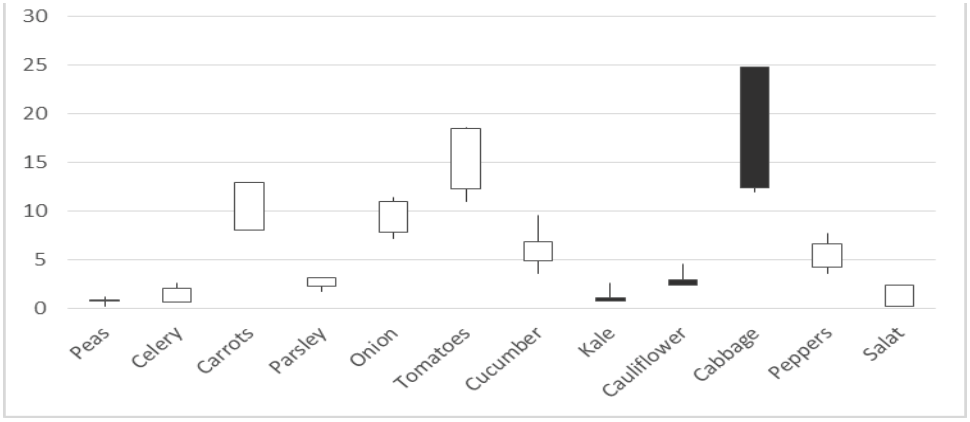
	Mean	Standard Error	Median	Standard Deviation	Kurtosis	Skewness	Confid. Level (95.0%)
Cucumber	7.23	0.39	7.70	1.69	0.14	-0.99	0.82
Kale	1.57	0.11	1.50	0.49	0.11	0.64	0.24
Cauliflower	3.22	0.13	3.40	0.58	-0.45	0.35	0.28
Cabbage	15.85	0.65	15.70	2.84	4.78	1.68	1.37
Paprika	6.18	0.27	6.50	1.19	-0.21	-0.90	0.57
Salat	1.31	0.15	1.50	0.63	-0.68	-0.31	0.31

Source: own calculations

The average consumption of parsley was 2.24 kg per person per year during the period under review. Actual consumption was scattered around the average by 0.39 kg. The distribution of consumption was flatter than normal, left-handed. The range of values was lower, 1.4 kg. The lowest consumption of parsley, 1.40 kg per person per year, was recorded in the highest consumption was in the year and it was 3.10 kg per person per year. The absolute increase in consumption was positive (Figure 1).

The lowest average consumption in the period under review was for kale (1.57 kg per person/year), celery (1.36 kg per person/year), lettuce (1.31 kg per person/year) and peas (0.75 kg per person/year). The standard deviation was also the lowest for these vegetables. The consumption of celery and lettuce had a positive absolute increase during the period under review. The distribution of both types of vegetables was flatter than normal. The distribution of lettuce was right-handed, that of celery left-handed. Consumption of cabbage and peas had a negative absolute increase. The distribution of both these vegetables was flatter than normal, left-handed. The difference between maximum and minimum consumption was highest for lettuce and celery (Figure 1).

Figure 1. Measures of variability of consumption of selected vegetables (2001-2019) in kg. capita^{1}. year^{1}



Source: own calculations; * the negative absolute increment is marked in black

Estimation of demand functions

The impact of own price, price of other goods and consumer income on the demand for individual vegetables was investigated using Marshall demand functions. Tables 2, 3 provide a glimpse of the basic tests of estimation by regression analysis and the estimated coefficients.

Table 2. Regression analysis results for the estimation of Marshall demand functions I.

Price (P), Income/demand for vegetable	Peas	Celery	Carrots	Parsley	Onion		Tomatoes
R square	0.73	0.78	0.80	0.78	0.78		0.80
F calc.	18.70	64.79	1132.79	71.08	60.51		406.92
P Peas	-1.23	-2.01	1.84	0.93	-10.95		5.15
P Celery	1.1	11.57	36.27	3.41	-37.66		53.47
P Carrots	6.18	2.83	40.62**	0.70	-4.54		67.48**
P Parsley	0.50	-2.99	-31.36**	-5.17	24.18		-55.15*
P Onion	-4.87	-5.34	-33.27***	5.22	6.7		-61.84**
P Tomatoes	-1.77	-2.18*	-9.25****	-2.28	1.40		-6.84
P Cucumb.	3.53	0.08	0.97	0.57	13.52		-4.05
P Kale	2.37	-14.94**	-27.13**	-6.27	-14.43		-65.76**
P Caulif.	0.02	11.48	24.01*	9.58	4.53		38.51
P Cabbage	-4.00	-2.30	-1.50	2.50	-27.93		49.12**
P Paprika	4.56	-2.09	3.67	-3.87	5.75		-6.52
P Salat	0.78	0.81	8.01***	0.32	-0.96		13.74**
Income	-0.01****	0.00	0.01***	0.00	0.00		0.04***

*P<0.15; ** P<0.10; ***P<0.05; ****P<0.01

Price in EUR.kg^{-1}, Income in EUR.capita^{-1}.year^{-1}, Quantity in kg.capita^{-1}.year^{-1}

Source: own calculations

The index of determination for each vegetable species ranged from 0.73 to 0.80. . Thus, the models explained a sufficiently high variability in the demand for different vegetables. F calculated was higher than F tabulated at 0.05 level of significance in all models. Thus, according to Fisher's test, the selected models explained the variation in demand for individual vegetables with 95% confidence. The results of the Student's test are shown in the table for each of the estimated coefficients through the α significance level. When estimating the demand for parsley and onions, the coefficients for the effect of own prices, prices of other vegetables, and the effect of income were not statistically significant. Demand for peppers, cucumbers and peas were characterized by statistically significant coefficients being estimated only for the effect of income on demand. Demand for celery was significantly influenced by the price of tomatoes and the price of kale. Demand for carrots was the most affected by prices of other vegetables. The coefficients

were significantly estimated for the price impact of carrots, parsley, onions, tomatoes, kale, cauliflower and lettuce. The income of residents also had a significant effect on the demand for carrots. The price of carrots, parsley, onions, cantaloupe, kale, cabbage, and lettuce had a significant effect on the demand for tomatoes. The effect of income was also significant. Only the price of cabbage significantly affected the demand for kale. The demand for cauliflower was significantly influenced by the prices of several types of vegetables. These were the prices of peas, carrots, parsley, onions, tomatoes and lettuce. The demand for cabbage was significantly affected by the price of peppers, the demand for lettuce and the price of carrots, in addition to income. The estimated coefficients, which were reliable, are further used to calculate elasticities (Table 4).

Table 3. Regression analysis results for the estimation of Marshall demand functions I.

Price (P), Income/demand for vegetable	Cucumbers	Kale	Cauliflower	Cabbage	Paprika	Salat
R square	0.79	0.74	0.79	0.77	0.79	0.79
F calc.	145.68	20.60	105.32	37.56	151.79	111.82
P Peas	-2.51	8.26	22.90***	72.06	4.41	-5.34
P Celery	7.75	-19.40	33.03	260.54	0.51	-12.13
P Carrots	-11.99	-10.28	26.15*	63.73	4.39	-11.41**
P Parsley	2.66	13.66	-29.72**	-110.79	-0.83	9.00
P Onion	-0.67	-0.47	-21.61*	-11.98	-3.41	4.67
P Tomatoes	2.33	0.84	-5.43***	-7.50	3.61	1.00
P Cucumb.	-19.66	8.33	-6.37	-83.90	-10.02	0.98
P Kale	-2.63	18.36	-20.27	-153.39	-8.37	2.6
P Caulif.	-5.97	-13.12	20.74	171.88	-0.77	-5.13
P Cabbage	19.55	-14.65***	9.51	66.64	8.36	-2.38
P Paprika	-2.97	4.27	-5.48	-67.87*	-4.02	2.62
P Salat	6.53	1.59	5.68**	6.70	2.15	-0.88
Income	0.03***	0.00	0.00	-0.08**	0.02***	0.01****

*P<0.15; ** P<0.10; ***P<0.05; ****P<0.01

Price in EUR.kg^{-1}, Income in EUR.capita^{-1}.year^{-1}, Quantity in kg.capita^{-1}.year^{-1}

Source: own calculations

Impact of income on demand for vegetables

According to the estimated Marshall demand functions, Tables 2,3 and the income elasticities of demand derived from them, income was found to be a significant determinant of demand for peas, carrots, tomatoes, peppers, cucumbers, cabbage and lettuce. The change in income had a twofold effect on vegetable demand. This effect depended on which vegetables were considered by Slovak consumers to be superior and

which inferior goods. Carrots, peppers and tomatoes emerged as superior, necessary goods. When consumers' income increased, the demand for these types of vegetables would increase less than income; the income elasticity of demand for these vegetables was in the interval (0;1), Table 4. A more pronounced change would be induced by a change in income in the demand for cucumbers and lettuce. If incomeincreased, demand for these vegetables would grow faster than income. Slovak consumers considered them luxuries, their income elasticity of demand was higher than 1. The opposite effect, i.e. a decrease in demand, would be exerted by an increase in income on the demand for peas and cabbage. These vegetables were considered inferior goods by Slovak consumers. Their income elasticity of demand was less than 0. This was particularly pronounced in the demand for peas, where the income elasticity of demand took the value of -4.82.

For the demand for celery, parsley, onion, kele and cauliflower, the income of the residents was not a significant determinant, based on the P-values from Tables 2 and 3. Based on this fact, we did not calculate income elasticities of demand from the estimated coefficients for these vegetables.

The research results show that demand for seasonal vegetables such as cucumbers and lettuce responded most elastically to the change in intake. These vegetables were luxury goods during the period under study. Tomatoes, peppers and carrots emerged as essential goods. Consumption of these vegetables formed the basis of total vegetable consumption in the period under review.

Table 4. Calculated elasticities according to the estimated Marshall functions of demand

Demand for vegetable	**Determinant**	**Elasticity**[1]
Peas	Income	-4.82****
Celery	Price of tomatoes	-1.36*
	Price of kale	-3.45**
Carrots	Price of carrots	1.61**
	Price of parsley	-1.74**
	Price of onion	-2.08***
	Price of tomatoes	0.08****
	Price of kale	-0.79**
	Price of cauliflower	1.25*
	Price of salat	0.89***
	Income	0.36***

Demand for vegetable	Determinant	Elasticity[1]
Tomatoes	Price of carrots	1.78**
	Price of parsley	2.03*
	Price of onion	-2.56**
	Price of kale	-1.27**
	Price of cabbage	0.63**
	Price of salat	1.02**
	Income	0.83***
Cucumber	Income	1.37***
Kale	Price of cabbage	-1.93***
Cauliflower	Price of peas	1.74***
	Price of carrots	3.46*
	Price of parsley	-5.50**
	Price of onion	-4.50*
	Price of tomatoes	-1.43***
	Price of salat	2.11**
Cabbage	Price of peppers	-2.80*
	Income	-1.81**
Peppers	Income	0.62***
Salat	Price of carrots	-3.73**
	Income	3.48****

Source: own calculations

*P<0.15; ** P<0.10; ***P<0.05; ****P<0.01

[1] Only elasticities with a confidence level greater than 85% were selected

Impact of own prices and prices of other vegetables on the demand for vegetables

By deriving own price elasticities and cross price elasticities of demand, we investigated the impact of prices on the demand for different types of vegetables.

Based on the P values in Tables 2 and 3, demand for no vegetable except carrots responded significantly to the change in own price. Therefore, only the price elasticity of demand for carrots was quantified.

The price of parsley affected the demand for cauliflower the most, followed by the demand for tomatoes and carrots. When the price of parsley increased by 10%, the demand for cauliflower decreased by 55% and carrots decreased by 17.4% (Table 4). These vegetables act as a complement. The opposite effect was induced by the price increase of parsley in the demand for tomatoes (increase of 20.3%) (Table 4). Slovak

consumers substituted these vegetables for each other. Demand for this vegetable responded elastically to the change in the price of parsley.

Demand also responded elastically to the change in the price of onions, which was particularly evident in the demand for carrots, tomatoes and cauliflower. All these vegetables acted as a complement to onions. If the price of onions increased by 10%, the demand for cauliflower would decrease by 45%, the demand for tomatoes by 25.6%, and the demand for carrots by 20.8%.

The price of carrots affected the demand for tomatoes, cauliflower and lettuce. Cauliflower and tomatoes acted as substitutes; lettuce acted as complements. A 10% increase in the price of carrots would cause the largest change in the demand for lettuce, which would decrease by 37.3%. The demand for cauliflower would increase by 34.6% along with a 10% increase in price, the demand for tomatoes would increase by 17.8%. Vegetable demand responds elastically to a change in the price of carrots. The price of carrots also has a statistically significant effect on the demand for carrots. However, the positive correlation between the two is not consistent with economic theory, , which assumes a negative correlation between price and quantity demanded. In practice, however, a positive price elasticity of demand is often encountered. This result can be interpreted as meaning that the population does not react to a rise in the price of carrots, probably because this vegetable is one of the staple vegetables of almost daily consumption.

The change in the price of cauliflower and peppers also responded elastically to the change in the demand for vegetables. When the price of cauliflower increased by 10%, the demand for carrots increased 12.5%. Slovak consumers would substitute this vegetable for cauliflower if its price increased. For peppers, the complement was cabbage. A 10% increase in the price of peppers would reduce the demand for cabbage by 28%.

Demand for vegetables reacted less strongly to the change in the price of other vegetables. The price of lettuce influenced demand for cauliflower, tomatoes and carrots. A 10% increase in the price of lettuce would increase demand for cauliflower by 21.1%, demand for tomatoes by 10.2% and demand for carrots by 8.9%. In response to a 10% increase in the price of kale, demand for celery would decrease 34.5%, demand for tomatoes would decrease 12.7%, and demand for carrots would decrease 7.9%. The price of tomatoes influenced the demand for celery, kale and carrots. With a 10% increase in the price of tomatoes, demand for kale decreased by 14.3%, demand for celery decreased by 13.6% and demand for carrots increased by 0.8%. The price of cabbage influenced the demand for tomatoes and cabbage. With a 10% increase in the price of cabbage, the demand for tomatoes increased by 6.3% and the demand for kale decreased by 19.3%. The price of peas influenced the demand for cauliflower and lettuce. With a 10% increase in the price of peas, the demand for cauliflower increased by 17.4%

The results of our research on cross-price elasticities show that different vegetables have both substitution and complementary links between them, which are mainly conditioned by dietary habits and the way in which meals are prepared. An example of this is onion vegetables, which are complementary to other vegetables, as they are mainly used in Slovak cuisine to flavour other vegetable dishes. Many substitute vegetables are tomatoes, which are also often used as a side dish for other dishes. Substitutes for tomatoes are, for example, cabbage, lettuce, or carrots or parsley, whose uses are very similar.

Discussion

Some studies confirm the non-elliptical behaviour of consumers to change the own price of individual foods. A study in Mexico, based on own price elasticity, found that 11 of the 12 products analysed reached values less than 1, i.e. demand for them is inelastic (Tinoco et al., 2011). Studies in Pakistan have similar results. The results of the compensated own price elasticities show that eight groups of food commodities have inelastic own price elasticities. This implies that these food commodities are an integral part of household diets (Hayat et al., 2023). Marshall elasticity results indicated that vegetable consumption in Pakistan is the least sensitive to own price change among all the commodities studied (Milojević et al., 2020; Naheed & Hussain, 2020). The findings of expenditure elasticity (uncompensated own price elasticity) show that vegetables and pulses are common (inelastic) goods while meat and fruits are luxury (elastic) goods (Mustafa et al., 2022). The price elasticity of 11 vegetables is negative. It shows that if the price of vegetables decreases, the total turnover in the vegetable market will increase due to the increase in the number of purchases (Liu et al., 2019). Demand for organic vegetables is price elastic as well as expenditure elasticities. Demand for conventional vegetables in the US is primarily inelastic (Kasteridis & Yen, 2012). Demand for vegetables in Tamil Nadu was elastic. The compensated own price elasticity in Tamil Nadu showed that nuts and oil in rural and urban households, meat in rural households and milk, eggs, vegetables and fruits in urban households were elastic to price change (Felix & Kumar, 2020). Our findings indicated that the demand of the Slovak population for different types of vegetables is not statistically significantly related to the own prices of vegetables. The only exception was the demand for carrots. Given the positive correlation between price and quantity demanded of carrots, we can infer a willingness to purchase this staple vegetable regardless of the change in its price.

According to the available research results on income elasticity of demand, vegetables are generally perceived as both a necessity and a luxury good. The results of income elasticities show that milk, meat and fruits are luxury foods. Non-essentials are cereals, pulses, vegetables, sugar and ghee. (Hayat et al., 2023). Income elasticity revealed that food group, milk and vegetables are essential goods in rural households but luxury goods in urban households (Felix & Kumar, 2020). If spending increases, consumers will increase their demand for organic vegetables faster than their demand for conventional vegetables (Schröck, 2013). Income elasticity results in our research

indicate that carrots, peppers and tomatoes are superior goods for Slovak consumers, cucumbers and lettuce are luxury goods, and peas and cabbage are inferior goods.

The cross-price elasticities appear to be asymmetric. Demand for organic vegetables is more sensitive to price changes of conventional vegetables than vice versa (Schröck, 2013). From the results of the uncompensated cross-price elasticity, consumers substitute vegetables with meat and vegetables with fruits. They purchase pulses together with vegetables and with meat (Mustafa et al., 2022). Ther is a mixture of gross substitution and complementarity among vegetable products, but the dominant pattern is pure substitution (Kasteridis & Yen, 2012). In terms of cross price elasticity and using green vegetables as an example, the cross-price elasticities between green vegetables and the following vegetables are positive, which means that the existing price elasticity between green leaves and the following vegetables substitution relationship: root vegetables, Chinese cabbage, kale, legumes, beetroot, mushrooms. The cross-price elasticity between green leaves and the following vegetables is negative, which means the existence of a complementary relationship between green leaves and solanaceous, allium, yam vegetables and buds (Liu et al., 2019).

Similarly, our research results indicated several substitution and complementary relationships in the vegetable market. Most of them were observed in the market for carrots and tomatoes, which are among the most consumed vegetables in Slovakia. Substitutes to tomatoes were, for example, cabbage, lettuce, carrots and parsley. The cross-price elasticity between the prices of these vegetables and the demand for tomatoes was positive. There was a negative price elasticity between the prices of onions and kale. These vegetables were complementary to tomatoes.

Conclusion

The aim of the paper was to investigate the impact of income and prices on the demand for vegetables in the Slovak Republic. The composition of demand for vegetables was relatively stable over the period under study. The highest demand was for tomatoes, cabbage, carrots and onions. The trend in the consumption of most vegetables was increasing over the period under review. Cabbage, together with kale, cauliflower and peas, had a decreasing trend in consumption.

Demand for each type of vegetable responded to the change in incomein varying degrees. Demand for carrots, peppers and tomatoes, which were considered essential goods by Slovak consumers, was less elastic. A more pronounced response to the change in incomewas observed in the demand for more luxurious vegetables such as cucumbers and lettuce and for inferior vegetables such as peas and cabbage.

Based on the fact that the coefficients quantifying the relationship between own price and demand for each type of vegetable were not statistically significant, it can be argued that demand depends more on the prices of other types of vegetables than on own price.The demand for cauliflower was the most elastic to changes in the price of other vegetables, which was influenced significantly by the price of parsley (ECPD=-5.50),

the price of onions (ECPD=-4.50) and the price of carrots (ECPD=3.46). Demand for lettuce was strongly influenced by the price of carrots (ECPD=-3.73). Demand for carrots, which is one of the most preferred vegetables in Slovakia, was the least elastic to the change in prices of other vegetables. The price of carrots, together with the price of parsley and onions, was among the significant determinants of demand for most vegetables.

Every country's nutrition and food policy seek a high consumption of fruit and vegetables. Regarding the consumption of vegetables such as lettuce, which has the lowest average consumption, it can be increased, for example, by increasing the income of the population or by lowering the price of carrots, which are a complement to lettuce for Slovak consumers. Further research in this area could aim to find out how consumers from different socio-economic backgrounds react to the vegetable market.

Conflict of interests

The authors declare no conflict of interest.

References

1. Deng, T., Berg, M., Heerink, N., Cui, H., Tan, F., Fan, S. (2023). Can homestead gardens improve rural households' vegetable consumption? Evidence from three provinces in China. *Agribusiness,* First published: 11 October 2023. Retrieved from https://doi.org/10.1002/agr.21855
2. Egbetokun, O.A. & Fraser, G.C.G. (2023). Farming households' food demand in Southwest Nigeria: An application of Substitution Elasticity Demand System (SEDS). *African Review of Economics and Finance-Aref*, 15(1): 56-66, Published JUN 2023, Indexed 2023-08-21 ISSN 2042-1478, eISSN 2410-4906. Retrieved from https://www.ajol.info/index.php/aref/article/view/270827
3. Felix, K.T., Kumar, P.N. (2020): An Economic Analysis of Food Demand in Rural and Urban Households of Tamil Nadu, *Indian Journal of Economics and Development*, 16(2):173-179, Indexed 2020-09-04. Retrieved from https://doi.org/10.35716/IJED/19100
4. Gimenez-Nadal, J. I. (2018). The Substitution Effect from the Profit Function in Consumption: Expressions from the Marshallian, Hicksian, and Frischian demand functions. *Economics and Business Letters*, *7*(3), 92–97. Retrieved from https://doi.org/10.17811/ebl.7.3.2018.92-97
5. Hayat. N., Mustafa. G., Alotaibi. BA., Nayak. RK., Naeem. M. (2023). Households food consumption pattern in Pakistan: Evidence from recent household integrated economic survey, *Heliyon*, 9(9) , Indexed 2023-10-12. Retrieved from https://doi.org/10.1016/j.heliyon.2023.e19518
6. Hudik, M. (2019). The Marshallian demand curve revisited. *The European Journal of the History of Economic Thought*, *27*(1), 108–130. Retrieved from https://doi.org/10.1080/09672567.2019.1651361

7. Kasteridis, P., & Yen, S. T. (2012). US Demand for Organic and Conventional Vegetables: A Bayesian Censored System Approach. *Australian Journal of Agricultural and Resource Economics*, *56*(3), 405-425. Retrieved from https://doi.org/10.1111/j.1467-8489.2012.00589.x

8. Lewbel, A. & Pendakur, K. (2009). Tricks with Hicks: The EASI Demand System. *American Economic Review*, 99 (3): 827–63. Retrieved from https://doi.org/10.1257/aer.99.3.827

9. Lippe, RS., Seebens, H., Isvilanonda, S. (2010). Urban Household Demand for Fresh Fruits and Vegetables in Thailand. *Applied Economics Journal*, 17(1), 1-26, Published JUN 2010, Indexed 2010-06-01. Retrieved from https://so05.tci-thaijo.org/index.php/TER/article/view/137355

10. Liu, LH, XU, WP et al. (2019). Empirical Analysis on the Mutual Substitution Relationship between Vegetables in Beijing Based on LA-AIDS Model. *International seminar on computer science and engineering technology. (SCSET 2018)*, Published 2019, Indexed 2019-07-01, ISSN 1742-6588, eISSN 1742-6596, Retrieved from https://doi.org/10.1088/1742-6596/1176/4/042082

11. Milojević, I., Mihajlović, M., & Pantić, N. (2020). Collection and documentation of audit evidence. *Oditor*, *6*(2), 77-90. https://doi.org/10.5937/Oditor2002077M

12. Miyake, M. (2006). On the applicability of Marshallian partial-equilibrium analysis. *Mathematical Social Sciences*, *52*(2), 176-196. https://doi.org/10.1016/j.mathsocsci.2006.05.003

13. Mustafa G., Huo WD., Pervaiz A., Ullah MR., Fiqar MZ. (2022): Validating LA/AIDS model in the food market of Pakistan, *Heliyon* 8(9), Indexed 2022-10-16. Retrieved fromhttps://doi.org/10.1016/j.heliyon.2022.e10699

14. Naheed, K. - Hussain, I. (2010). Elasticity measurement of food demand in Pakistan: Cross Price and own Price Elasticity Analysis. *International Transaction Journal of Engineering Management and applied Sciences and Technologies*, 11(5), Published 2020, Indexed 2020-03-04. Retrieved from https://doi.org/10.14456/ITJEMAST.2020.99

15. Pendakur, K. (2009), Chapter 7 EASI Made Easier, Slottje, D.J. (Ed.) *Quantifying Consumer Preferences* (*Contributions to Economic Analysis, Vol. 288*), Emerald Group Publishing Limited, Leeds, pp. 179-206. Retrieved from https://doi.org/10.1108/S0573-8555(2009)0000288010

16. Schröck, R. (2013). Quality and Endogeneity Issues in Demand Systems: A comparative Estimation of Price and Expenditure Elasticities of the Demand for Organic and Conventional Vegetables in Germany, *German Journal of Agriculture Economics*, 62(1), 18-38, Published 2013, Indexed 2013-11-07. Retrieved from https://www.gjae-online.de/articles/quality-and-endogeneity-issues-in-demand-systems-a-comparative-estimation-of-price-and-expenditure-elasticities-of-the-demand-for-organic-and-conventional-vegetables-in-germany/

17. Smith, PL. (2018). A new approach to calculating welfare measures in Kuhn-Tucker demand models, *Journal of Choice Modelling*, 26, 19-27. ISSN 1755-5345. Retrieved fromhttps://doi.org/10.1016/j.jocm.2017.12.002

18. Sproule, Robert, (2013). A systematic analysis of the links amongst the Marshallian, Hicksian, and Frischian demand functions: A note, *Economics Letters*, Elsevier, vol. 121(3), 555-557. Retrieved from https://doi.org/10.1016/j.econlet.2013.10.004
19. Tinoco, JR., Damián, MAM., Mata, RG., Garay, AH., Flores, JSM. (2011). An almost ideal demand system (AIDS) applied to beef, pork and chicken cuts, eggs and tortillas in Mexico for the period 1995-2008. *Revista Mexicana de Ciencias Pecuaria*, 2(1), 39-51, Published JAN-Indexed 2011-01-01.Retrieved from https://www.scielo.org.mx/scielo.php?script=sci_abstract&pid=S2007-11242011000100004&lng=pt&nrm=iso&tlng=en
20. Ulubasoglu, M., Mallick, D., Wadud, M., Hone, P. and Haszler, H. (2016), Food demand elasticities for Australia†. *Aust Agric Resour Econ*, 60: 177-195. Retrieved from https://doi.org/10.1111/1467-8489.12111
21. Weatherspoon, D., Oehmke, J., Dembele, A., & Weatherspoon, L. (2015). Fresh vegetable demand behaviour in an urban food desert. *Urban Studies*, *52*(5), 960-979. Retrieved from https://doi.org/10.1177/0042098014529340

OPTIMIZATION OF TRANSPORT ACTIVITIES IN THE SUGAR BEET HARVESTING CAMPAIGN

Dejan Brcanov[1], Stojanka Dakić[2], Danilo Đokić[3] Nebojša Gvozdenović [4], Stanislav Zekić [5]

**Corresponding author E-mail: dejan.brcanov@ef.uns.ac.rs*

ARTICLE INFO

Original Article

Received: *12 November 2024*

Accepted: *15 December 2024*

doi:10.59267/ekoPolj2501155B

UDC 631.37:[631.558:633.63

Keywords:

optimization, harvesting, transport, strategy

***JEL**: C61, Q13, Q15*

ABSTRACT

This paper explores the optimization of sugar beet transport from loading points to processing plants throughout the harvest campaign. An optimization model was developed to address the key logistical aspects of this process. The approach was applied to data from a company that encompasses 50% of Serbia's sugar beet processing, with operations across three sugar factories. The results include an evaluation of the current operating method and the analysis of two alternative scenarios that present further opportunities to reduce logistical costs. These savings not only lower company expenses but also contribute to reduced greenhouse gas emissions, underscoring both economic and environmental benefits.

Introduction

Production and processing of sugar beet in the European Union (EU) play a significant role in the European agribusiness complex. Over the past decade, sugar beet has been cultivated in the EU on approximately 1.5 million hectares, accounting for about 2% of the total temporary crops. With relatively high average yields (around 70 tons/ha), the total annual production of sugar beet exceeds 100 million tons, while sugar

1 Dejan Brcanov, Associate professor, Faculty of economics Subotica, University of Novi Sad, Segedinski put 9-11, 24000 Subotica, Serbia, Phone: +381214852923, E-mail: dejan.brcanov@ef.uns.ac.rs, ORCID ID (https://orcid.org/0000-0003-4059-5232)

2 Stojanka Dakić, Associate professor, Faculty of economics Subotica, University of Novi Sad, Segedinski put 9-11, 24000 Subotica, Serbia, Phone: +38124628011, E-mail: stojanka.dakic@ef.uns.ac.rs, ORCID ID (https://orcid.org/0000-0002-2416-7847)

3 Danilo Đokić, Assistant professor, Faculty of economics Subotica, University of Novi Sad, Segedinski put 9-11, 24000 Subotica, Serbia, Phone: +381214852942, E-mail: danilo.djokic@ef.uns.ac.rs, ORCID ID (https://orcid.org/0000-0002-7962-4910)

4 Nebojša Gvozdenović, Full professor, Faculty of economics Subotica, University of Novi Sad, Segedinski put 9-11, 24000 Subotica, Serbia, Phone: +38124628000, E-mail: nebojsa.gvozdenovic@ef.uns.ac.rs, ORCID ID (https://orcid.org/0000-0002-9230-9528)

5 Stanislav Zekić, Full professor, Faculty of economics Subotica, University of Novi Sad, Segedinski put 9-11, 24000 Subotica, Serbia, Phone: +381214852945, E-mail: stanislav.zekic@ef.uns.ac.rs, ORCID ID (https://orcid.org/0000-0003-3872-1332)

production reaches around 18 million tons. Depending on the year, sugar beet in Serbia is cultivated on over 40.000 hectares, which, with somewhat lower yields (around 50 tons/ha), results in an annual production of just over 2 million tons of sugar beet and over 300.000 tons of sugar (FAOSTAT, 2024).

Transporting sugar beet to processing facilities, i.e., sugar factories, represents a complex logistical campaign process that encompasses the logistics of harvesting, storage, and transportation. The specific characteristics of sugar beet, including its high-water content (about 75%) and rapid sugar loss after harvest, make this logistics chain particularly challenging. To reduce economic and environmental costs, sugar factories have been strategically located near production fields for more than two centuries, enabling efficient transport of sugar beets to process plants. However, with changes in industry structure and factory closures, the need for continuous optimization has become more pronounced. The average distance between fields and sugar factories in the EU-27 was only 44 kilometers in 2009 (van Campen, Marihart, 2010).

In recent decades, the EU sugar industry has faced increasingly stringent environmental requirements while maintaining a focus on cost rationalization. In many countries, efforts are being made to streamline sugar beet transport costs by employing larger vehicles or even using rail transport, which can contribute to significant cost reduction and lower greenhouse gas emissions.

Optimization of transport costs is also significant from the point of view of impact on the environment. One of the objectives of the Farm to Fork strategy is to ensure that the food chain, covering food production, transport, distribution, marketing, and consumption, has a neutral or positive environmental impact. This indicates that the EU is focused on reducing the harmful environmental effects of food production along the entire chain (European Commission, 2020). In the same document, it is emphasized that the manufacturing, processing, retailing, packaging, and transportation of food significantly contribute to air, soil, and water pollution and GHG emissions and profoundly impact biodiversity.

The primary goal of the research in this paper is to develop a mathematical model for optimizing sugar beet transport costs, specifically to reduce travel distance and, consequently, the transport costs of sugar beet from loading sites to processing facilities. The main research hypothesis is that applying a transport optimization model can achieve significant savings in travel distance, and thus in transport costs. After a literature review and problem description, an optimization model is presented that covers transport activities in the process of collecting sugar beets from fields to sugar factories. The model is applied to the Sunoko d.o.o. that accounts for approximately 50% of sugar beet processing in Serbia through its ownership of three sugar factories: “Bačka” in Vrbas, “Donji Srem” in Pećinci, and “Jedinstvo” in Kovačica. Options for optimizing transport routes to maximize efficiency are analyzed. The results of applying the model are presented through an analysis of the current operations, as well as two additional scenarios that provide insight into potential additional savings in the sugar beet supply chain.

The literature on optimization of sugarcane and sugar beet supply chains covers many aspects, from transport scheduling and synchronization to risk management and strategic decision-making, the complexity of these supply chains demands robust models capable of addressing both operational and long-term planning needs.

Sugar beets contain around 75% water, which constitutes a significant portion of their weight, creating a considerable impact on transport costs and efficiency. Due to these challenges, sugar processing factories in Europe have been strategically located close to sugar beet fields for more than 200 years, predominantly in rural areas with a goal to reduce transport costs and harmful gas emissions.

The European sugar industry continuously strives to reduce both the environmental and economic impact of transport through process optimization. In the UK, although the number of factories has decreased from 17 to 4, increasing the average transport distance from 29 km to 45 km, the total distance traveled by vehicles has been halved due to larger vehicles, improved crop quality, and a reduction in soil content during transport. Similarly, in Italy, the introduction of new machinery has reduced soil content by 50% over the past ten years, while Austria transports approximately 50% of its sugar beet by rail, significantly lowering emissions. In Germany, Denmark, and Sweden, systematic sugar beet cleaning in the fields has drastically reduced the amount of soil transported to factories, optimizing costs and lessening the environmental impact (van Campen, Milojević et al., 2020; Marihart, 2010).

Transportation costs represent a substantial component of total production expenses within the global sugar industry. In Australia, for instance, the transportation of sugarcane constitutes approximately 15% of overall production costs, equating to AU$4.00 per ton (Higgins, 2006). Efficient scheduling of transport, particularly when synchronized with harvesting activities, is essential for cost minimization. This review explores various optimization models developed to tackle the complexities of agricultural supply chains, focusing on strategies to enhance logistical efficiency and reduce costs. Higgins (1999) introduced a large-scale integer programming model to optimize cane supply decisions, aiming to maximize profitability across entire mill regions. The model incorporated multiple constraints related to milling capacity, transportation logistics, and equitable distribution, and it was solved using a heuristic approach. The process began with a linear programming approximation, followed by a novel local search technique incorporating dynamic oscillation to explore both feasible and infeasible solutions. This dynamic oscillation approach can also be applied to other heuristic methods, such as tabu search and simulated annealing, making it a versatile tool for complex supply chain problems. Fikry (2021) proposed a comprehensive model addressing the integrated challenges of production, logistics, and crop rotation within the sugar beet supply chain. This mathematical model sought to minimize total transportation and storage costs while accounting for the unique characteristics of agro-food production. A key innovation was the inclusion of a time dimension, which enabled the model to accommodate multiple cropping seasons, thereby increasing its relevance over extended planning horizons. Similarly, Paiva & Morabito (2009) developed an optimization model to

support decision-making in the aggregate production planning of sugar and ethanol milling companies. The mixed-integer programming model facilitated decisions on industrial process selection, sugarcane quantities to be processed, supplier choices, and inventory strategies for final products. The planning horizon encompassed the entire sugarcane harvesting season, with decisions made at discrete intervals, thereby ensuring comprehensive coverage of operational processes.

Effective transport mode selection is critical to managing costs and reducing environmental impact. Lopez-Milan (2006) highlighted the importance of carefully planning the allocation of road and rail transport based on availability and cost. Road transport, often more expensive due to fuel consumption, must be balanced against the cost-effectiveness of rail. His model optimized the capacities of road and rail systems to ensure a steady supply to processing mills while streamlining daily transport operations. In Austria, for example, approximately 50% of sugar beet is transported by train, resulting in significant emissions reductions (van Campen, Marihart, 2010).

Synchronization between harvesting and transport is another critical component of logistical efficiency. Gvozdenović & Brcanov (2018) developed a model to synchronize large fleets of vehicles and loading machines during the harvest, aiming to minimize waiting times and maximize operational efficiency. Their approach demonstrated that effective synchronization could significantly reduce delays and improve resource utilization (Literature review 3). Similar principles were observed in other logistics sectors by Bala et al. (2010) and Bala et al. (2017), who demonstrated that synchronization is crucial across various logistical problems, from newspaper delivery to multi-echelon distribution, and highlighted the parallels with agricultural supply chains.

Agricultural supply chains are inherently exposed to risks arising from unpredictable weather patterns and long supply lead times. Behzadi (2018) explored these vulnerabilities, noting that such factors complicate post-harvest activities like packing, processing, and transport. Supply spikes can overwhelm logistics systems, while resource degradation over time exacerbates these challenges. The work of Rong et al. (2011) and van der Vorst et al. (2009) further underscored the need for robust logistics planning to mitigate these risks.

Harvest planning in the sugar industry is constrained not only by logistical and resource limitations but also by the need to maintain a consistent supply to processing facilities. Jena (2013) examined the difficulties of maximizing profitability while adhering to industrial, social, and environmental constraints. He highlighted the challenge of harvesting each field at its optimal maturity due to logistical constraints and limited capacity, which often results in suboptimal yields. In a related field, Ali et al. (2009) studied path planning for agricultural vehicles and robotics to identify optimal routes for crop harvesting. The limited bin capacity of combine harvesters, which necessitates frequent grain unloading, presented a major challenge. The problem was initially modeled as a vehicle routing problem with turn penalty constraints, producing feasible routes for harvest and grain transfer. However, as problem instances grew larger, solution times

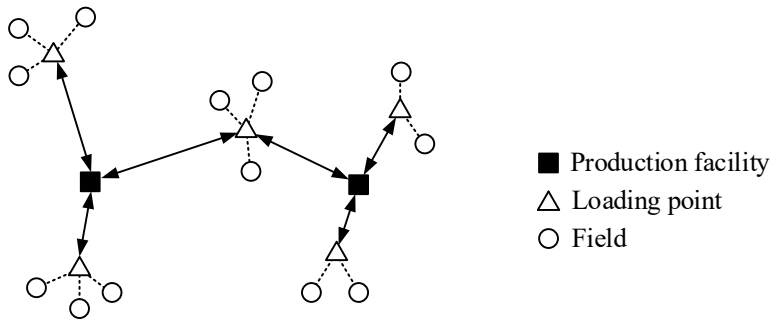
increased dramatically. To overcome this, the model was reformulated as a minimum-cost network flow problem, enabling more efficient solutions for medium-sized fields.

Materials and methods

Harvest planning for sugar beet is conducted in a way that enables optimal profit, considering the impact of numerous factors. Profit directly depends on variables such as fuel prices, availability of labor and fleet, available machinery for sugar beet harvesting and loading onto transport vehicles, as well as the maturity and quality of the sugar beet. On the other hand, continuous operation of production capacities is one of the most important factors, which allows for some deviation from optimal behavior. Specifically, the biggest issue in this chain is the lack of raw material in production facilities. Therefore, ensuring an uninterrupted processing flow can be viewed in two ways: either as the ultimate goal or as a constraint in the optimization process.

The focus of the research is not on decision-making regarding the timing of sugar beet harvesting or decisions about storing it at loading points, but rather on the process of transporting sugar beet to the factory. Sugar beet is collected from multiple fields, and sugar beet piles are placed at convenient locations near paved roads. At these locations, loading machines transfer the sugar beets into transport vehicles, so it is essential to have adequate maneuvering space to carry out these operations effectively. The sugar beets are then transported by trucks to processing facilities. Given that multiple production facilities are involved, a key question arises: which production facility should each truckload of raw material be directed to?

Figure 1. Typical transportation scheme



Source: Authors

Figure 1 provides an illustration of sugar beet transport involving two production facilities and five loading points. All sugar beet from the fields is transported along routes marked by dashed lines to the loading points, while the transport analyzed in this study focuses on the routes between loading points and production facilities, shown with solid lines. Although the allocation of two left and two right loading points seems straightforward, the position of the central loading point raises the question of which production facility, left or right, it should be assigned to.

Since the locations of production facilities are fixed and cannot be changed without significant investment, the positions of fields and loading points greatly impact overall transport costs. Additionally, road quality can significantly affect the situation, as transport on paved roads often consumes less time and fuel compared to movement on dirt roads between fields. Furthermore, weather conditions can influence transport efficiency; vehicle capacities can be fully utilized when trucks travel on asphalt, whereas traveling on dirt roads may reduce load capacity due to poor conditions. All these specific factors must be considered when the dispatcher decides on the optimal truck route.

Additionally, the transport process is directly linked to optimizing the operation of production capacities, as a continuous inflow of raw materials ensures maximum utilization of facilities, thereby increasing profitability. However, improper planning or transport delays can cause production stoppages, leading to unused capacity and potential losses. The key challenge, therefore, lies in balancing the dynamics of harvesting, the location of loading points (piles of sugar beet), available routes, and production facility capacities to minimize transport costs and ensure uninterrupted production.

Beyond geographic factors, such as the distance between fields and facilities and road quality, weather conditions and the seasonal nature of harvesting and production further complicate decision-making. Taking all these factors into account, the manager must carefully plan each step to minimize costs, optimize transport time, and ensure a steady supply of raw materials to production facilities.

To define a model, let I represent the set of indices corresponding to the loading points. For each $i \in I$, let q_i denote the quantity of sugar beet at loading point i. Let J be the set of indices representing the factories or production facilities. We denote by d_{ij} the distance between each loading point $i \in I$ and factory $j \in J$. Without loss of generality, we assume the distance matrix is symmetric, meaning $d_{ij} = d_{ji}$.

The transport cost between two locations is denoted by c_{ij}. These costs are expressed as cost per kilometer and are directly related to the distance between locations d_{ij}. Additionally, we assume that the capacity of each production facility is given as the maximum quantity of sugar beet that can be delivered, including storage space within the facility. This capacity is denoted by C_j, for each $j \in J$.

Let's define a binary variable x_{ij} as follows:

$$x_{ij} = \begin{cases} 1, & \text{if the sugar beet from loading point } i \text{ is transported to factory } j \\ 0, & \text{otherwise} \end{cases}$$

This variable will help in formulating the optimization model by indicating whether a specific transport route from loading point $i \in I$ to factory $j \in J$ is selected (when $x_{ij} = 1$) or not (when $x_{ij} = 0$).

With the proposed notation, the optimal costs can be determined by solving the following model:

$$\min \sum_{i \in I} \sum_{j \in J} d_{ij} c_{ij} q_i x_{ij} \tag{1}$$

$$\sum_{i \in I} q_i x_{ij} \leq C_j, \text{for each } j \in J. \tag{2}$$

$$\sum_{j \in J} x_{ij} = 1, \text{for each } i \in I. \tag{3}$$

$$x_{ij} \in \{0,1\}, \text{for each } i \in I, j \in J. \tag{4}$$

In equation (1), we define the optimization objective, which is to minimize the total costs. Relation (2) ensures that the factory's capacity constraint is satisfied, meaning the total amount of sugar beets collected cannot exceed the factory's total capacity. Equation (3) imposes the condition that all available sugar beets from each loading point are delivered to the factories. The constraint (4) defines the binary nature of the variable x_{ij}.

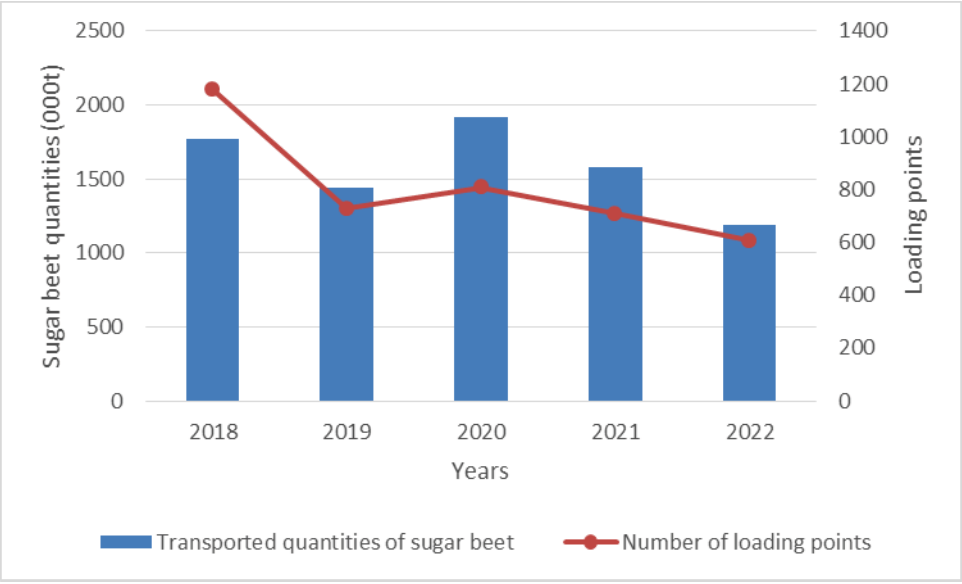
Results and discussion

The presented model is developed to optimize the transportation of sugar beets for any business system with at least two sugar factories receiving sugar beet deliveries. In this study, the model is tested on a case involving three sugar factories within the same business system. The data source is a business system Sunoko d.o.o. that owns sugar beet processing factories located in different regions of Vojvodina: central Bačka Vrbas, eastern Srem Pećinci, and southern Banat Kovačica. Collected data on sugar beet transportation covers a five-year period from 2018 to 2022, a cycle in which sugar beets reappear in crop rotation, returning to the same plot of land. The quantity of sugar beets transported to these factories between 2018 and 2022 represents about 50% of Serbia's total sugar beet production (Collected Data and SORS, 2024), suggesting that the model's application could conditionally be considered as an optimization of sugar beet transportation at a national level. Implementing the developed model is expected to lead to cost savings in transportation, significantly enhancing the operational efficiency of sugar beet production. The results review is divided into two parts: the first section describes key indicators for the current operation of the analyzed sugar production business system, while the second section outlines potential savings achieved through the application of the sugar beet transportation optimization model.

Existing Operating Method

The analyzed business system owns three sugar factories located in the Autonomous Province of Vojvodina, where nearly all of Serbia's sugar beet production takes place (SORS, 2024).

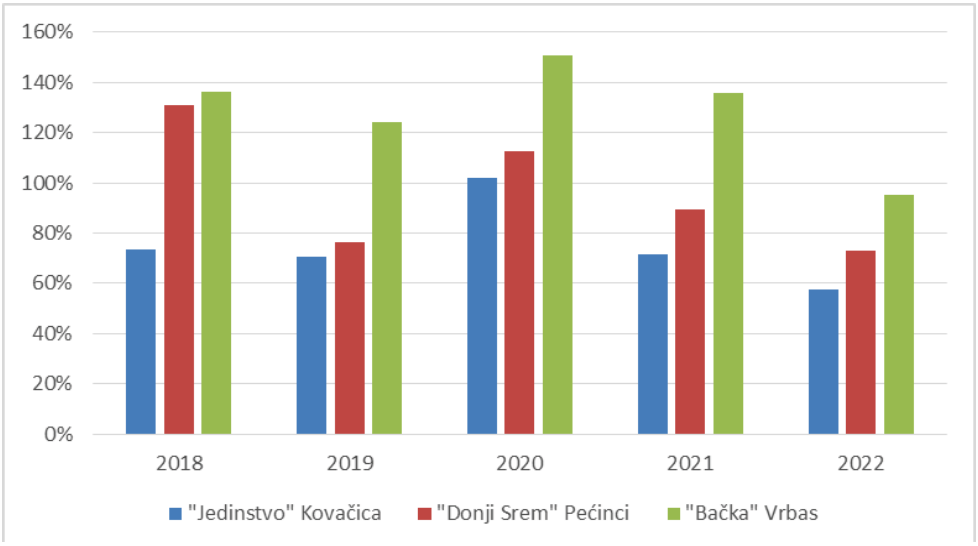
Figure 2. Transported average quantities per loading point and the number of loading points over the period 2018-2022.



Source: Authors' calculations based on collected data

The quantities of transported sugar beets during the analyzed period, along with the number of loading locations, are shown in Figure 2. Except for 2018, a certain alignment between the quantities and the number of loading locations can be observed. Throughout the entire observation period, the average quantity of sugar beets per loading location is approximately 1.960 tons. The sugar beets are processed in three factories, each differing in daily processing capacity and number of operating days. The quantities of processed sugar beets by year and production facility are shown in Figure 3, which also presents deviations from the average processed sugar beet quantity as percentages. Notably, in each of the observed years, the factory "Bačka" in Vrbas records a higher production volume than the other factories.

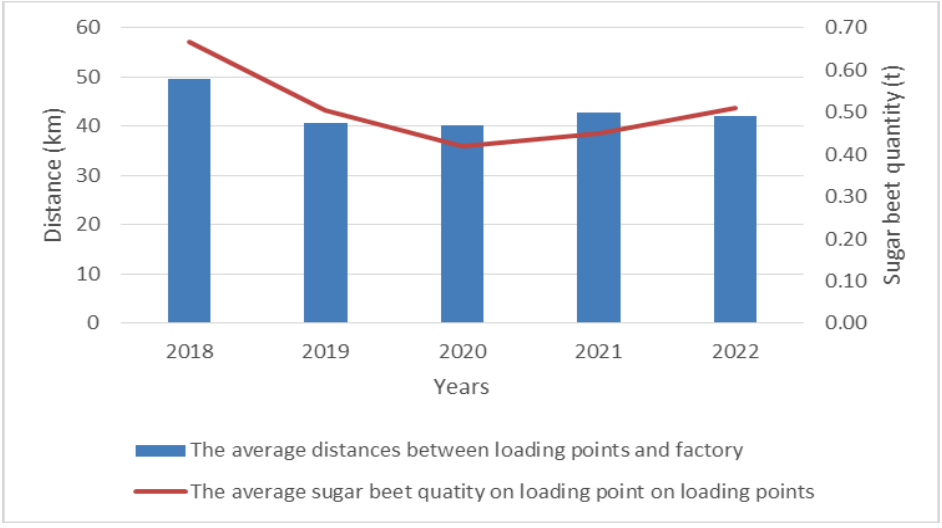
Figure 3. Percentages of working days per factory and year over the period 2018-2022.



Source: Authors' calculations based on collected data

The differences in processed quantities arise not only from production capacities but also from the duration of the processing campaign. Figure 3 illustrates this, where we can also observe greater deviations in the number of operating days at the "Bačka" factory compared to the other factories.

Figure 4. The average distances between loading points and factories and sugar beet quantities on loading points



Source: Authors' calculations based on collected data

The cost aspect can also be examined through the distance from loading locations to production facilities. Reviewing the implementation plan, Figure 4 provides a comparative overview of the average distance and average quantity of sugar beets at loading locations by year. The average distance over the observed period is approximately 43,8 km, which is comparable to the European average of 44 km (van Campen, Marihart, 2010).

Table 1 presents an overview of transportation costs, the number of truck trips, and the distance traveled by loaded trucks per year. Although transportation costs were highest in 2018, the largest quantity of transported sugar beets was recorded in 2020.

Table 1. The overview of transport activities

Year	Transportation costs (RSD)	The number of truck routes	Travelled distance (km)
2018	847.078.989	63.245	3.524.537
2019	574.285.335	51.614	2.068.339
2020	782.442.517	68.571	2.844.234
2021	670.240.120	56.299	2.481.688
2022	449.364.304	42.371	1.588.729
Total	3.323.411.264	282.099	10.707.835
Average	664.682.253	56.420	2.141.567

Source: Authors calculations based on collected data

Potential savings with model

To analyze the current performance of this production system, optimization was applied to each of the given years, with results compared after each season. The analysis assumes that each factory operates within its realized capacity, allowing for optimization through different allocations of loading locations. Thus, factory capacities are set to match the annual quantities of processed sugar beets for each observed year. Additionally, each year is treated independently, resulting in five separate sub problems to solve. Potential savings from this approach are presented in Table 2.

Table 2. The potential savings per year and in total over the period 2018-2022

Year	Transportation costs (RSD)	Travelled distance (km)
2018	789.966.697	2.963.240
2019	571.504.510	2.055.398
2020	752.493.734	2.698.181
2021	645.348.266	2.358.882
2022	437.722.661	1.534.143
Total	3.197.035.869	10.158.614
Average	639.407.174	2.031.723
Savings	-3,80%	-5,13%

Source: Authors calculations based on collected data

As shown in Table 2, savings in transportation costs vary annually, ranging from 0,48% to 6,74%. Considering the total amount of sugar beets transported over this period, the overall savings amount to 3,80%. At the same time, with similar annual variations, total distance savings reach 5,13%. Consequently, the average distance from loading locations to the sugar factories is reduced to 43,24 km, a decrease of 1,30% compared to the current implementation.

Beyond evaluating current operations, the model can also be utilized for medium-term planning. Two scenarios are presented below, outlining conditions for achieving further cost savings.

Scenario 1. Aggregate tactical planning

This approach relies on historical data and projections of future activities, encompassing all loading locations and factory capacities, and treating them as a unified, aggregated problem based on the five-year processed sugar beet quantity. Since sugar beets are not planted on the same fields each year, but typically rotate to the same sites every 3-5 years, field locations and consequently, loading locations and raw material quantities vary over time. A five-year period is considered sufficiently long to approximate these shifts in field and loading point distribution, as well as yield fluctuations, thereby enabling tactical decision-making.

The geographic aspect and density of loading locations near factories become particularly significant in this approach. Consolidating all loading sites with factory capacities adjusted to five-year demands allows for greater flexibility in resource allocation. This modification of input data, compared to the analysis of the current state, creates space for further optimization and potential savings, as shown in Table 3. Total savings in transportation costs amount to 4,67%, while distance traveled is reduced by 6,34%. The average distance between loading locations and factories decreases to 42,18 km, a reduction of 3,73%.

Scenario 2. Tactical planning with additional capacities

Sugar beets are a crop that tolerates cooler climates well, which, along with favorable weather conditions, allows the harvest and processing campaign to extend into the early winter months. Extending the campaign provides additional operational days for sugar factories, thus increasing production capacity and creating opportunities for further savings. In a scenario without capacity constraints (by removing constraint (2) from the optimization model) it becomes possible to estimate minimum costs under ideal conditions. In this case, geographic distance remains the only critical factor in optimization, allowing the model to provide insight into target costs that the system should aim to achieve.

This approach results in significant optimizations, as shown in Table 3, with the allocation of loading locations to factories optimized. Transportation cost savings reach 9,61%, while the total distance traveled by trucks carrying sugar beets is reduced by 12,70%. The average distance between loading locations and sugar factories decreases

to 38,11 km, which is 13,02% less than the distance achieved in the current scenario. This model highlights the potential savings that could be realized through further optimization and adjustment of the logistical system for sugar beet processing.

Table 3. The potential savings under scenario and 2

Indicator	Scenario 1		Scenario 2	
	Value	Savings	Value	Savings
Total transport costs	3.168.297.232 RSD	-4,67%	3.003.913.537 RSD	-9,61%
Total travelled distance	10.028.790 km	-6,34%	9.347.643 km	-12,70%
Average distance between loading points to factories	42,18 km	-3,73%	38,11 km	-13,02%

Source: Authors calculations based on collected data

To implement this transportation plan, additional processing capacity is needed, which can be addressed by determining the optimal campaign duration for each factory. Considering the existing processing capacity and the allocated sugar beet quantities, we conclude that to achieve this transportation plan, the factory "Jedinstvo" in Kovačica would need to reduce its operating days during the season by approximately 10 days, the factory "Donji Srem" in Pećinci by 17 days, while the factory "Bačka" in Vrbas would need to extend its operation by 20 days. If it is technically feasible to extend the operating days of the "Bačka" factory, the potential savings in transportation costs would be substantial.

However, this raises the question of the feasibility of extending the operation of one factory and the challenges of reducing operating days for the other two, which goes beyond the scope of this study.

Conclusions

Sugar beet production and processing form an economically significant part of the agribusiness sector and are also crucial for national food security. Given that sugar beets are bulky and must be transported from the field to processing facilities within a relatively short time, the logistics of transporting sugar beets from farm to factory is highly complex. Additionally, high transportation costs impact the utilization of existing capacities, thereby influencing operational efficiency. In this context, there is a strong interest in exploring ways to optimize and reduce transportation costs. This is feasible only if the sugar-producing enterprise operates multiple processing facilities located at significant distances from each other.

This study presents a model for optimizing transportation costs from loading points to sugar factories, applied to a production entity that owns three sugar factories located in northern Serbia (Vojvodina), where nearly all of the country's sugar beet production is concentrated. The factories are located in Vrbas, Pećinci, and Kovačica, collectively transporting approximately 50% of Serbia's total sugar beet production. The study's findings demonstrate potential savings achievable through optimization methods. Assuming all three factories operate at existing capacities, the projected savings in

distance traveled is 5,13%, with transportation cost savings of 3,80%. Given that these savings are relatively modest, alternative methods to reduce costs have also been explored.

The first alternative considers optimization over a five-year period during which sugar beets rotate within the crop cycle and return to the same plots. With this approach, savings are somewhat higher, resulting in a 6,34% reduction in distance traveled and a 4,67% reduction in costs. The second alternative involves optimization without capacity constraints on individual factories. Given that the factories do not operate at full capacity, this is a relatively feasible approach. This scenario yields substantial savings, with a 12,70% reduction in distance traveled and a 9,61% reduction in transportation costs. The distance from loading points to the factory decreases by as much as 13,02%, significantly more than the 3,73% reduction observed in the first alternative. This underscores that, without strategic planning, including the flexibility to adjust factory operating capacities, it is challenging to achieve substantial savings in raw material transport costs.

It is essential to note, however, that changes in operating capacity, specifically extending the operating days of individual factories, introduce other production and business challenges that fall outside the scope of this study. This limitation represents a key constraint of the research.

Reduction of transport costs by optimizing the distance traveled also reduces fuel consumption, which has a positive environmental effect. It can be concluded that this method can proportionally reduce GHG emissions approximately within a given range. Future research will focus on a more detailed analysis of environmental effects.

Acknowledgements

This research was funded by the Provincial Secretariat for Higher Education and Scientific Research of Autonomous Province of Vojvodina, the Republic of Serbia during the project Assessment of economic performance of the agricultural and food sector of AP Vojvodina, grant number 142-451-3482/2023-03.

Conflict of interests

The authors declare no conflict of interest.

References

1. Ali, O., Verlinden, B., & van Oudheusden, D. (2009). Infield logistics planning for crop-harvesting operations. *Engineering Optimization*, *41*(2), 183–197. https://doi.org/10.1080/03052150802406540
2. Bala, K., Brcanov, D., & Gvozdenović, N. (2017). Two-echelon location routing synchronized with production schedules and time windows. *Central European Journal of Operations Research*, *25*(3). https://doi.org/10.1007/s10100-016-0463-6

3. Bala, K., Brcanov, D., Gvozdenović, N., (2010). *Meeting points positioning in Newspaper distribution*, Euro Working Group on Locational Analysis 65 (5).
4. Behzadi, G., O'Sullivan, M. J., Olsen, T. L., & Zhang, A. (2018). Agribusiness supply chain risk management: A review of quantitative decision models. *Omega*, *79*, 21–42. https://doi.org/10.1016/j.omega.2017.07.005
5. van Campen, J., Marihart, J. (2010). The EU Beet and Sugar Sector: A model of environmental sustanability, Retrieved from https://www.cibe-europe.eu/Brochures, (05.06.2024).
6. European Commission. (2020). Farm to fork strategy: for a fair, healthy and environmentally-friendly food system. Available at: https://food.ec.europa.eu/horizontal-topics/farm-fork-strategy_en
7. FAOSTAT (2024). Official database. Retrieved from: http://www.fao.org/faostat/en/#home (8.11.2024)
8. Fikry, I., Gheith, M., & Eltawil, A. (2021). An integrated production-logistics-crop rotation planning model for sugar beet supply chains. *Computers & Industrial Engineering*, *157*, 107300. https://doi.org/10.1016/j.cie.2021.107300
9. Grunow, M., Günther, H.O., & Westinner, R. (2007). Supply optimization for the production of raw sugar. *International Journal of Production Economics*, *110*(1–2), 224–239. https://doi.org/10.1016/j.ijpe.2007.02.019
10. Gvozdenović, N., & Brcanov, D. (2018). Vehicle scheduling in a harvest season. *Ekonomika Poljoprivrede*, *65*(2), 633–642. https://doi.org/10.5937/ekoPolj1802633G
11. Higgins, A. (2006). Scheduling of road vehicles in sugarcane transport: A case study at an Australian sugar mill. *European Journal of Operational Research*, *170*(3), 987–1000. https://doi.org/10.1016/j.ejor.2004.07.055
12. Higgins, A. J. (1999). Optimizing cane supply decisions within a sugar mill region. *Journal of Scheduling*, *2*(5), 229–244. https://doi.org/10.1002/(SICI)1099-1425(199909/10)2:5<229::AID-JOS29>3.0.CO;2-L
13. Jena, S. D., & Poggi, M. (2013). Harvest planning in the Brazilian sugar cane industry via mixed integer programming. *European Journal of Operational Research*, *230*(2), 374–384. https://doi.org/10.1016/j.ejor.2013.04.011
14. Jonkman, J., Barbosa-Póvoa, A. P., & Bloemhof, J. M. (2019). Integrating harvesting decisions in the design of agro-food supply chains. *European Journal of Operational Research*, *276*(1), 247–258. https://doi.org/10.1016/j.ejor.2018.12.024
15. Lopez Milan, E., Miquel Fernandez, S., & Pla Aragones, L. M. (2006). Sugar cane transportation in Cuba, a case study. *European Journal of Operational Research*, *174*(1), 374–386. https://doi.org/10.1016/j.ejor.2005.01.028
16. Milojević, I., Mihajlović, M., & Pantić, N. (2020). Collection and documentation of audit evidence. *Oditor*, *6*(2), 77-90. https://doi.org/10.5937/Oditor2002077M

17. Paiva, R. P. O., & Morabito, R. (2009). An optimization model for the aggregate production planning of a Brazilian sugar and ethanol milling company. *Annals of Operations Research*, *169*(1), 117–130. https://doi.org/10.1007/s10479-008-0428-9

18. Rong, A., Akkerman, R., & Grunow, M. (2011). An optimization approach for managing fresh food quality throughout the supply chain. *International Journal of Production Economics*, *131*(1), 421–429. https://doi.org/10.1016/j.ijpe.2009.11.026

19. Statistical Office of Republic of Serbia (2024). Official database. Retrieved from: https://data.stat.gov.rs/ (8.11.2024)

20. van der Vorst, J. G. A. J., Tromp, S.-O., & Zee, D.-J. van der. (2009). Simulation modelling for food supply chain redesign; integrated decision making on product quality, sustainability and logistics. *International Journal of Production Research*, *47*(23), 6611–6631. https://doi.org/10.1080/00207540802356747

THE INFLUENCE OF SOCIO-DEMOGRAPHIC VARIABLES ON THE STATE OF ENVIRONMENTAL AWARENESS OF THE RURAL AREAS POPULATION - EXAMPLE OF SERBIA

Jelena Premović[1], Marko Pavlović[2], Marija Perić[3]

**Corresponding author E-mail: jelena.premovic@gmail.com*

ARTICLE INFO

Original Article

Received: *27 November 2024*

Accepted: *15 January 2025*

doi:10.59267/ekoPolj2501171P

UDC 316.334.55:502.12(497.11)

Keywords:

sustainable development, ecology, environment, environment concern, environment protection, ecological awareness

***JEL**: Q01, R11, O13, O18*

ABSTRACT

The purpose of this research was to determine the influence of certain socio-demographic variables on the state of environmental awareness of local population of the five areas in Serbia. For that purpose, an original empirical research was conducted. Age, gender, education and place of residence of the respondents were used as independent variables. The analysis was done using SPSS version 26.0 software in October 2024. The main intend of authors ware to define the level of environmental activity of the respondents, their assessment of the current ecological situation in their local environment, as well as their assessment of concern for environmental problems. Based on the analysis of the obtained results, it can be concluded that the respondents have an above-average expression when it comes to the environmental activities they carry out. Applying the comparative scientific method, it was concluded that statistically significant differences exist only in relation to the age of the respondents.

Introduction

The protection and improvement of human environment is an important issue mankind faces up to early 21st century until today, due to which the development of a new attitude towards nature and human environment is turning into one of imperatives of the modern society. Spending lifestyles and environmentally destructive technologies have led to

1 Jelena Premović,Ph.D., Full Profesor, Faculty of Economics and Engineering Management, University Business Academy, Cvećarska 2, 21000 Novi Sad, Republic of Serbia, Phone: +38164 144 17 98, E-mail: jelena.premovic@gmail.com, ORCID ID (https://orcid.org/0009-0001-8052-4802)

2 Marko Pavlović, lecturer, Academy of Vocational Studies Polytechnic, Belgrade, Katarine Ambrozić n. 3, 11120 Belgrade, Serbia, Phone: +381 64 219 48 81, E-mail: markopavlovic25101982@gmail.com, ORCID ID (https://orcid.org/0000-0003-1817-9734)

3 Marija Perić, lecturer, Academy of Vocational Studies Polytechnic, Belgrade, Katarine Ambrozić n. 3, 11120 Belgrade, Serbia, Phone: +381 64 338 96 65, E-mail: maki.peric84@gmail.com, ORCID ID (https://orcid.org/0009-0002-4673-2568)

the intensification of the already existing environmental problems (Premović, Boljević, 2016). Therefore, acceptance of ecological-ethical principles, greening of general social awareness, turning from industrial to ecological culture become imperative and a condition for further survival and development (Miltojevic et al., 2011). Socially responsible behavior implies the integration into business activities of the concept of concern for social issues, environmental protection, concern for all stakeholders and all issues that affect the quality of life in the long term (Stojić et al., 2024). Increasing physical volume caused the disruption of the natural environment, but on the other hand, increases the environmental awareness of the whole world society about the necessity of the sustainable development and environmental protection.

Sustainable development, which today faces major challenges, is a prerequisite for the development of rural areas. It is based on economic, ecological and socio-cultural principles that together lead to development (Ignjatović et al., 2024; Jović et al., 2024). It is "a tendency to make the world a better place, balancing social, economic and environmental factors is a harmonious relationship between ecology and economy, which aims to preserve the world`s natural resources for future generations" (Marjanović et al., 2019). At its core, sustainability aims to conserve resources (natural, human and created) while promoting efficiency and fairness (Jež Rogelj et al., 2024). As authors (Paparić et al., 2024) indicate "there is a continuous emergence of new ideas that enable improvements in sustainable development research respecting economic models (circular economy - CE, green economy - ZE and bio economy - BE) and sustainability models (development, maintaining the existing state and slowing down development)".

Developing environmental awareness and responsible behavior is crucial for achieving sustainable development. According to Fayyaz et al. (2023) "it is widely recognized that establishing effective, sustainable development policies can be complicated without proper awareness and understanding of the elements that encourage people to recycle". The term environmental awareness can be defined in many different ways. One of the first definitions dates back to 1978 in a report by the German Advisory Council on the Environment which defined environmental awareness as "understanding of the threat to man's natural environment by man himself, combined with the willingness to remedy this danger" (https://www.umweltbundesamt.de/en/publikationen/environmental-awareness-in-germany-2018). Environmental awareness can be defined as a conscious behavior towards the environment like the pro-environmental behavior (Handayani et al. 2021). It is "an art of imparting knowledge in people so that they develop new environmental perception. In as far as environmental awareness is concerned, three major steps have to be taken according to; knowledge of the present environmental status, what should be done and how to nurture environmental knowledge" (Milimo Dauti, M., 2014). According to the Enger and Smith (2013) environmental awareness is the ability to understand environmental issues and respective actions one needs to take to reach the good practice for realizing a sustainable environment (Handayani et al., 2021; Luković et al., 2024). In opinion of Hanisch et al., (2014) environmental

awareness is to attend to an environmental issue and its respective action leading to realizing a good practice to achieve a sustainable environment. It is "the level to which people worry about the impacts that their actions cause on the environment, other people, and the biosphere" (Hidalgo-Crespo et al., 2022). Agarwal (2018) states that environmental sustainability may be achieved when environmental awareness is performed in an integrated manner by all elements of the people, such as the scientists, engineers, and other communities. Lizuka (2000) point out that until recently, people's awareness was never considered as a possible tool to promote environmental policy. However, this tool is actually important and has potential to be a powerful tool in environmental sphere, concludes author. Walters et al., (2022) discovered strong proof that environmental awareness encourages initiatives that can lead to beneficial behavior. This study supports that ecological awareness is essential for developing greener behavior and attitude (Handayani et al., 2021). Environmental awareness constitutes an ultimate drive to green behavior as a pro-environmental behavior.

Materials and methods

Applying the historical and comparative method in researching the origin and development of ecological awareness, the conclusion was reached that environmental awareness can be surveyed in different ways. For instance, respondents can be asked about their attitudes, opinions and behavior in order to find out how environmentally conscious and educated they are. There is relatively limited number of study on environmental awareness in developing countries so it is quite urgent, as author underline that empirical study on environmental awareness to be carried out in developing countries (Lizuka, 2000).

Respecting the previous knowledge and based on the fact that "largest part of the territory of Serbia as much as 85%, according to OECD criteria, belongs to the so-called rural areas where live 55% of the total population in Serbia and where are most natural resources with rich ecosystems and biodiversity" (Premović, 2016) an original empirical research was conducted in order to investigate the level of environment awareness of the rural population of the Serbian territory. Although the Serbian rural areas characterized "by a high degree of differentiation in terms of size and morphology of the village, natural conditions and infrastructure facilities" as well as „in the field of social development, demographic trends, economic development, quality of life, environmental and other characteristics" (Premović, 2016) in research participated local rural population which for the purposes of this paper is divided into five areas: from Belgrade Region, Region of Vojvodina, region of Šumadija and Western Serbia, Southern and Eastern Serbia region and from Kosovo and Methohija. The total research sample consists of 200 respondents. The research period is December 2023 to April 2024. The purpose of this study was to determine the influence of certain socio-demographic variables on the state of environmental awareness of the rural areas population in Serbia. As independent variables in the research, the following were used: age, gender, education and place of residence of the respondents. The main goal of the research was

to define the level of environmental activity of the respondents, their assessment of the current ecological situation in their local environment, as well as their assessment of concern for environmental problems. Also, in the examination, were included questions related to the degree of pollution and ways to protect the environment.

When it comes to the gender of the respondents (Table 1), the majority of the sample consists of respondents of the female gender (61.0%) and a smaller part of the respondents of the male gender (39.0%). The sample is not uniform according to the gender of the respondents.

Table 1. Structure of the sample in relation to age, level of professional education, place of residence and social status of the respondents

AGE	**F**	**%**	**PLACE OF RESIDENCE**	**F**	**%**
to 25 years	31	15,5	Belgrade Region	63	31,5
25-35 years	59	29,5	Region of Vojvodina	54	27,0
35-45years	50	25,0	Šumadija and Western Serbia	56	28,0
45-55 godina	26	13,0	Southern and Eastern Serbia	10	5,0
over 55 years	34	17,0	Kosovo and Methohija	17	8,5
∑	**200**	**100,0**	∑	**200**	**100,0**
PROFESSIONAL EDUCATION				**F**	**%**
secondary vocational education				10	5,0
high school				26	13,0
faculty (MSc, PhD)				164	82,0
∑				**200**	**100,0**

Source: Authors

In relation to the age of the respondents (Table 1), the majority of respondents from the research are between 25 and 35 years old (29.5%). Respondents aged 35 to 45, who make up a quarter of the entire sample (25.0%), are in second place in terms of number. After that, there are respondents who are over 55 years old (17.0%), then respondents who are less than 25 years old (15.5%), and in the research, respondents who are between 45 and 55 years old (13.0%) are the least represented. The sample is not uniform according to the age of the respondents, but each age category has minimum frequencies that meet the needs of further analysis. In relation to the level of professional education, most respondents included in the research have completed a university degree and/or a master's degree/doctorate (82.0%). Respondents with completed college or university (13.0%) or completed secondary education (5.0%) are represented in a significantly smaller percentage. The sample is not uniform according to the level of professional education of the respondents. According to the respondent's place of residence, the majority of respondents have their place of residence in the Belgrade region (31.5%). This is followed by respondents residing in the region of Šumadija and Western Serbia (28.0%) and respondents residing in the region of Vojvodina (27.0%). A significantly smaller part of the sample of respondents consists of respondents who reside in the

region of Southern and Eastern Serbia (5.0%) and the region of Kosovo and Methohija, which make up 8.5% of the entire sample of respondents.

Results

In order to conduct research and collect data on the topic of environment protection, ecology and environment awareness, a questionnaire consisting of five parts was created. The first four units consist of closed-type, Likert-type questions with respondents' responses scaled from 1 to 5. The following four units consist of questions that are grouped as: Activities of the respondents related to ecology (Ecological activities) - EA (questions 1 to 5), Evaluation of the ecological state - EES (questions 6 to 14), Assessment of concern for environmental problems - ACEP (questions 15 to 20), Assessment of the degree of pollution - ADP (questions 21 to 25). In addition, the questionnaire included several closed-type questions with the possibility of multiple choices related to the examination of environmental protection, identification of the largest polluters, responsibility for the implementation of environmental activities and the respondents' willingness to engage in these activities.

Environmental activities of respondents (EA)

The environmental activity scale consists of five questions with answers from 1- Never to 5- Very often, all questions have a direct direction and a higher score on the scale indicates more frequent application of certain activities. The goal of the question is to examine which activities related to ecology and being in nature are implemented by the respondents. The obtained reliability of the scale (measured by Cronbach's alpha coefficient) is α=0.770.

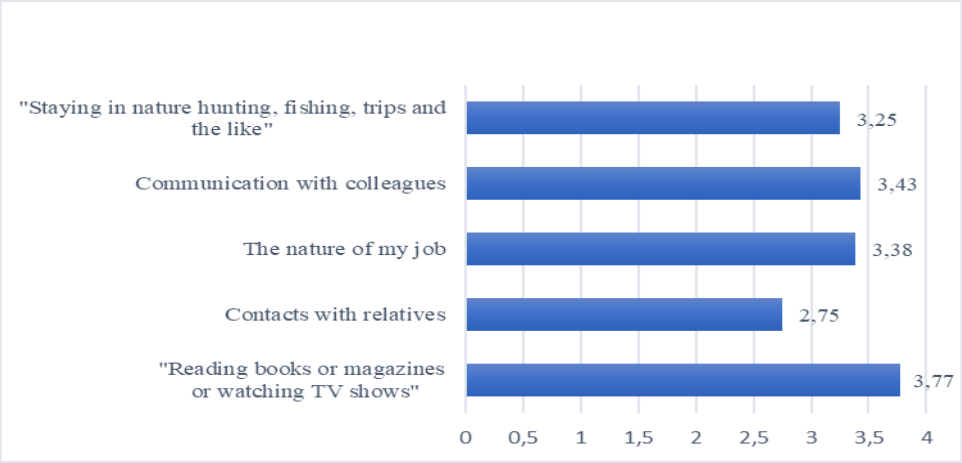
Table 2. Expression of EA in the entire sample of respondents

Skala	MIN	MAX	AS	SD
EA	1	5	3,31	0,820

Source: Authors

The obtained findings show (Table 2) that expression on the EA scale is above average (AS=3.31, SD=0.820). The empirical minimum is 1 and the maximum is 5. When it comes to expression on certain questions from the EA framework, the highest expression was obtained for questions 5. Reading books (magazines) or watching television shows that deal with environmental topics (AS=3.77, SD=0.986) and 2. Communication with colleagues encourages me to take care of the state of the environment (AS=3.43, SD=1.077) and the lowest expression was obtained for question 4. My contacts with relatives encourage me to take care of environmental condition (AS=2.75, SD=1.338) (Chart 1).

Figure 1. Expressiveness of EA scale statements



Source: Authors

Evaluation of the ecological condition (EEC)

The EEC scale consists of 9 Likert-type questions with a response range from 1- Much worse to 5- Much better. A higher score on the scale indicates that the situation in certain aspects of environmental assessment is better now than it was in the past. All questions have a direct direction and Cronbach's alpha coefficient for the scale is α=0.861.

Table 3. Expression of EEC in the entire sample of respondents

Scale	MIN	MAX	AS	SD
EEC	1	5	2,45	0,667

Source: Authors

The obtained findings show that at the level of the entire sample of respondents (Table 3), the average grade AS=2.45, SD=0.667, i.e. slightly below the theoretical average. The empirical minimum is 1 and the maximum is 5. At the level of individual questions from this scale, the highest score was obtained for question 14. Quality of water supply (AS=3.01, SD=0.743) and 6. Treatment of waste water in the environment where you live and work (AS=2.80, SD=1.050) and these are also the only questions on which expression above the theoretical average was obtained. The lowest expression was obtained when it comes to statement 9. Rational use of energy in traffic (AS=2.04, SD=0.896) (Graph 2).

Assessment of concern for environmental problems (ACEP)

The ACEP scale consists of 6 Likert-type questions, with a response range from 1 - I don't think about it to 5 - I am very worried. A higher score on this scale indicates greater concern of respondents for environmental problems in our country. The reliability of the scale is α=0.834 and all questions have a direct direction.

Table 4. Expression of ACEP in the entire sample of respondents

Scale	MIN	MAX	AS	SD
ACEP	1	5	3,84	0,676

Source: Authors

The results obtained from the research showed that (Table 4) the respondents are above average concerned about the environmental problems of the Republic of Serbia. The average on the level of the entire scale is AS=3.84, SD=0.676, the empirical minimum is 1 and the maximum is 5. Respondents showed the greatest concern in relation to 20. Air pollution due to traffic (AS=4.23, SD=0.897) and 16. Quality of basic foodstuffs (AS=4.13, SD=8.93) and the lowest expression was obtained in relation to concern for 15. Energy provision for different users (AS=3.33, SD=0.918). It is important to note that for all statements from this scale, an above-average expression was obtained, which is an indicator that the respondents are really very concerned about environmental problems.

Assessment of the degree of pollution (ADP)

When it comes to the ADP scale, this scale consists of 5 Likert-type questions. The range of respondents' answers ranges from 1- Not polluted to 5- Very polluted, and a higher score on the scale indicates a higher degree of pollution. All questions have a direct direction and the reliability of the scale measured by Cronbach's alpha coefficient is α=0.877.

Table 5. Expression of ADP in the entire sample of respondents

Scale	MIN	MAX	AS	SD
ADP	2	5	3,49	0,673

Source: Authors

The obtained findings show that the assessment of the degree of pollution is above average (AS=3.49, SD=0.673). The empirical minimum is 2 and the maximum is 5. According to the respondents, the biggest problem exists in relation to 22. Rate the level of air pollution in your area (AS=3.62, SD=0.849) and 24. Rate the local pollution problem (AS=3, 55, SD=0.857) and respondents are the least concerned about 21. Rate the level of water pollution in your area (AS=3.32, SD=0.768). It is important to note that a high above-average expression was obtained for all the statements of this questionnaire and that the level of pollution is very high according to the opinion of the respondents.

Table 6. *What does environmental protection mean to you?*

Assertion	**f**	**%**
1. Condition of standard of living and preservation of quality of life	144	72,0
2. Responsibility towards new generations	138	69,0
3. Sustainable development	78	39,0
4. Waste management	53	26,5
5. Need to satisfy needs	17	8,5
6. The condition to preserve natural resources	91	45,5

Source: Authors

Environmental protection EP

The fifth section of the questionnaire, as already mentioned, is an examination of methods of environmental protection, identification of the biggest polluters and activities that are carried out in order to improve the general ecological condition in our country. For the majority of respondents (Table 6), environmental protection represents 1. A condition for living standards and preserving the quality of life (72.0%) and 2. Responsibility towards new generations (69.0%). In addition, slightly less than half of the respondents agree that environmental protection is the 6th condition to preserve natural resources (45.5%) and more than a third of the respondents believe that environmental protection is the 3rd condition for sustainable development (39.0%). Also, a quarter of respondents believe that it is 4. Waste management (26.5%).

Table 7. *Who should solve environmental problems*

Assertion	f	%
1. Non-governmental organizations	12	6,0
2. International organization	22	11,0
3. Local self-government	73	36,5
4. The one who polluted	50	25,0
5. Country	71	35,5
6. Citizen	47	23,5
7. All together	133	66,5

Source: Authors

Table 8. *Who should finance environmental protection*

1. State from the budget	182	91,0
2. Someone from abroad	10	5,0
3. Local self-government funds	107	53,5
4. Bank loans	1	0,5
5. Environmental Protection Fund	83	41,5
6. I don't have an answer	2	1,0

Source: Authors

When it comes to solving pollution problems (Table 7), the majority of respondents, slightly less than two-thirds of the entire sample, believe that we should all solve environmental problems together (66.5%). In addition, 36.5% of respondents believe that it is a problem of local self-government and 35.5% that it is a problem of the state. Also, 25.5% of the respondents believe that environmental problems should be solved by the one who polluted, and 23.5% believe that the solution to that problem lies with the citizens.

In relation to who should finance environmental protection (Table 8), most respondents believe that it is the responsibility of the state (91.0%). In addition, more than half of the respondents believe that the local self-government should also provide financing for environmental protection (53.5%), and 41.5% cite the fund for environmental protection as a means of financing.

Table 9. *The most important factor of environmental protection*

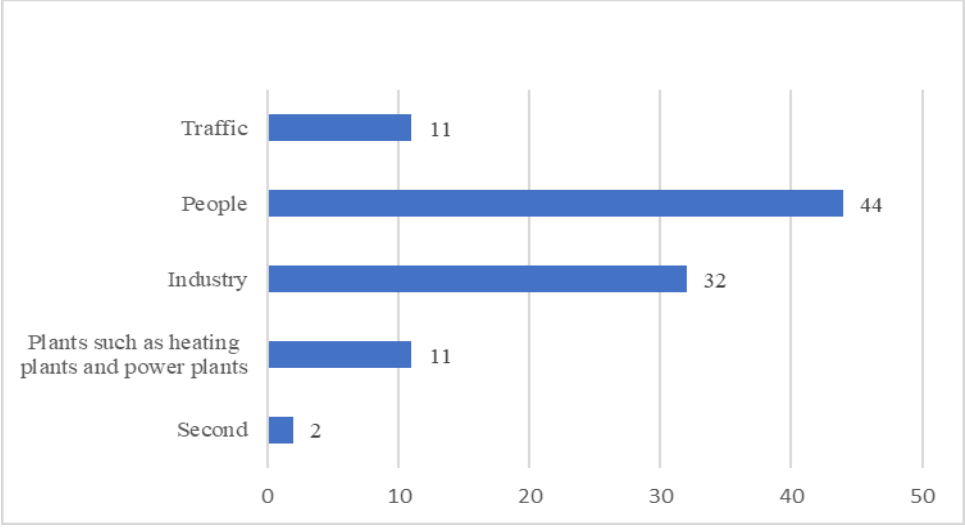
Assertion	f	%
1. Reduction of the number of pollutants	80	40,0
2. Construction of ecological infrastructure	86	43,0
3. Efficient and numerous inspection	74	37,0
4. Greater number of pollution preventions through a series of measures and activities of key factors responsible for the state of the environment	91	45,5
5. Better standard of living	30	15,0
6. Active implementation of "green" legislation and implementation of the European Union Law	67	33,5

Source: Authors

In relation to the most important factors of environmental protection (Table 9), to the greatest extent the respondents opted for Greater number of pollution prevention through a series of measures and activities of key factors responsible for the state of the environment (45.5%) and Construction of ecological infrastructure (43, 0%).

In addition, respondents often chose Reducing the number of pollutants (40.0%), as well as Efficient and numerous inspection (37.0%) as effective environmental protection factors.

Figure 1. The biggest polluters



Source: Authors

According to the respondents (Figure 1.), the biggest polluters of the environment are people (44.0%) and industry (32.0%). A significantly smaller percentage of respondents chose answers such as heating and power plants (11.0%) or traffic (11.0%).

When it comes to EU membership and the impact on environmental protection, more than half of respondents (53.0%) believe that EU membership would contribute to

environmental protection, and 41.5% are not sure. In addition, 5.5% of respondents believe that joining the European Union would not lead to an improvement in the environmental situation in Serbia.

Comparative analysis

In addition to the examination of the respondents' Activities related to ecology (Ecological activities) - EA, Environmental condition scale Assessments of the ecological state - EEC, Assessments of concern for environmental problems - ACEP and Assessments of the degree of pollution - ADP, the research also foresees the examination of these aspects of environmental awareness in relation to the sociodemographic characteristics of the respondents: gender, age, level of professional education, place of residence, social status and amount of monthly income.

Gender of the respondent

When it comes to the gender of the respondents (Table 10), the comparative analysis showed that there are no statistically significant differences for any of the four scales used. In general, on all scales, the expression obtained in female respondents is higher than in male respondents. The exception is the EEC environmental condition scale, where a higher score was obtained for male respondents (AS=2.50, SD=0.743) compared to female respondents (AS=2.41, SD=0.613). As mentioned, the obtained differences in expression did not show statistical significance.

Table 10. *Differences in EA, EEC, ACEP and ADP in relation to the gender of the respondents*

Scale	Gender	AS	SD	t	p
EA	*Male*	*3,28*	*0,784*	*-0,440*	*0,661*
	Female	*3,33*	*0,845*		
EEC	*Male*	*2,50*	*0,743*	*0,971*	*0,333*
	Female	*2,41*	*0,613*		
ACEP	*Male*	*3,73*	*0,750*	*-1,904*	*0,058*
	Female	*3,91*	*0,616*		
ADP	*Male*	*3,43*	*0,769*	*-1,058*	*0,291*
	Female	*3,53*	*0,604*		

df=200; *Source:* Authors

Age of the respondents

In relation to the age of the respondents (Table 11), statistically significant differences were confirmed for the EA (F=2.644, p=0.035) and ACEP (F=4.139, p=0.003) scales. The first obtained difference is significant at the $p<0.05$ level and the second is significant at the $p<0.01$ significance level. Subsequent analysis showed that on the Environmental Activities scale, respondents aged 25 to 35 years (AS=3.10, SD=0.896) have significantly lower scores compared to respondents under 25 years of age (AS=3.52, SD=0.811) , respondents aged 45 to 55 years (AS=3.51, SD=0.607) and respondents older than 55 years (AS=3.51, SD=0.799).

Table 11. *Differences in EA, EEC, ACEP and ADP in relation to the age of the respondents*

Scale	age	AS	SD	F	p
EA	*to 25 years*	*3,52*	*0,811*	***2,644***	***0,035****
	25-35 years	*3,10*	*0,896*		
	35-45 years	*3,21*	*0,787*		
	45-55 years	*3,51*	*0,607*		
	>55 years	*3,51*	*0,799*		
EEC	*to 25 years*	*2,62*	*0,764*	*0,955*	*0,433*
	25-35 years	*2,41*	*0,629*		
	35-45 years	*2,37*	*0,634*		
	45-55 years	*2,55*	*0,753*		
	>55 years	*2,38*	*0,616*		
ACEP	*to 25 years*	*3,88*	*0,605*	***4,139***	***0,003****
	25-35 years	*3,59*	*0,794*		
	35-45 years	*4,08*	*0,525*		
	45-55 years	*3,76*	*0,669*		
	>55 years	*3,96*	*0,590*		
ADP	*to 25 years*	*3,34*	*0,729*	*1,481*	*0,209*
	25-35 years	*3,41*	*0,620*		
	35-45 years	*3,58*	*0,698*		
	45-55 years	*3,70*	*0,580*		
	>55 years	*3,49*	*0,714*		

df=200; *Source:* Authors

On the ACEP scale, follow-up analysis (LSD) showed that respondents aged 25 to 35 years (AS=3.59, SD=0.794) had significantly lower scores compared to respondents aged 35 to 45 years (AS=4.08, SD=0.525) and respondents aged over 55 (AS=3.96, SD=0.590). In addition, on the scale of concern for environmental problems, it was confirmed that respondents aged 35 to 45 have significantly higher scores compared to respondents aged 45 to 55 (AS=3.76, SD=0.669). On the other scales (EEC and ADP), no statistically significant differences in expression were confirmed in relation to the age of the respondents.

Vocational degree

When it comes to the professional education of the respondents (Table 12), no statistically significant differences in expression were confirmed for any of the four scales used. Relatively close to the statistical significance of $p<0.05$, but not significant, is the difference obtained for the EA scale ($F=2.568$, $p=0.079$). On this scale, the highest score was obtained by respondents with completed higher or higher education (AS=3.64, SD=0.936) and the lowest by respondents with completed university (master's/doctorate) - AS=3.26, SD=0.799. In addition, respondents with a higher/higher education and respondents with a university degree gave the highest ratings of the environmental condition, while respondents with a secondary education showed the greatest concern for environmental problems. On the degree of pollution rating scale, the respondents who graduated from the faculty gave the highest ratings.

Table 12. *Differences in EA, EEC, ACEP and ADP in relation to the level of education*

Scale	Professional education	AS	SD	F	p
EA	secondary vocational education (SVE)	3,42	0,702	2,568	0,079
	high school	3,64	0,936		
	faculty (MSc, PhD)	3,26	0,799		
EEC	secondary vocational education (SVE)	2,27	0,503	0,383	0,682
	high school	2,46	0,597		
	faculty (MSc, PhD)	2,46	0,688		
ACEP	secondary vocational education (SVE)	3,92	0,610	0,118	0,889
	high school	3,88	0,468		
	faculty (MSc, PhD)	3,83	0,709		
ADP	secondary vocational education (SVE)	3,30	0,738	1,052	0,351
	high school	3,36	0,519		
	faculty (MSc, PhD)	3,52	0,689		

df=2; *Source:* Authors

Place of residence

In relation to the respondent's place of residence (Table 13), no statistically significant differences in the expressiveness of the scores were confirmed for one of the scales used. The highest score on the Ecological Activity scale was obtained by respondents from the region of Southern and Eastern Serbia, and the lowest by respondents from the region of Belgrade.

Table 13. *Differences in EA, EEC, ACEP and ADP in relation to the place of residence*

Scale	Place of residence	AS	SD	F	p
EA	*Belgrade Region*	*3,22*	*0,915*	*0,831*	*0,507*
	Region of Vojvodina	*3,29*	*0,722*		
	Šumadija and Western Serbia	*3,39*	*0,783*		
	Southern and Eastern Serbia	*3,68*	*0,661*		
	Kosovo and Methohija	*3,31*	*0,946*		
EEC	*Belgrade Region*	*2,38*	*0,656*	*0,749*	*0,560*
	Region of Vojvodina	*2,44*	*0,675*		
	Šumadija and Western Serbia	*2,55*	*0,681*		
	Southern and Eastern Serbia	*2,58*	*0,518*		
	Kosovo and Methohija	*2,32*	*0,733*		
ACEP	*Belgrade Region*	*3,87*	*0,711*	*0,098*	*0,983*
	Region of Vojvodina	*3,85*	*0,665*		
	Šumadija and Western Serbia	*3,81*	*0,677*		
	Southern and Eastern Serbia	*3,88*	*0,766*		
	Kosovo and Methohija	*3,79*	*0,585*		

Scale	Place of residence	AS	SD	F	p
ADP	*Belgrade Region*	*3,51*	*0,700*	*0,317*	*0,866*
	Region of Vojvodina	*3,51*	*0,609*		
	Šumadija and Western Serbia	*3,41*	*0,682*		
	Southern and Eastern Serbia	*3,54*	*0,674*		
	Kosovo and Methohija	*3,59*	*0,783*		

df=4; *Source:* Authors

On the EEC and ACEP scales, the highest scores were obtained by respondents from the regions of South and Eastern Serbia, and the lowest by respondents from the Kosovo region, while on the scale of the degree of pollution, the highest score was obtained by respondents from the Kosovo region, and the lowest score was given by respondents from the Šumadija region and Western Serbia.

Discussions

The obtained findings showed that the respondents have an above-average expression when it comes to the environmental activities they carry out. The highest expression on this scale was obtained for the statements Reading books (magazines) or watching television shows dealing with environmental topics and Communication with colleagues encourages me to take care of the state of the environment, and the lowest expression was obtained for the statement My contacts with relatives encourage me to take care of the state of the environment.

On the scale of the Environmental Status Assessment (EA), a grade slightly below the theoretical average was obtained, which could indicate that the situation is not hopeless, but that there is certainly room and need to improve. At the level of individual statements, the highest expression was obtained when it comes to Quality of water supply and Wastewater treatment in the environment where you live and work, and the lowest score was obtained for the statement Rational use of energy in traffic.

When it comes to the assessment of concern for environmental problems, it was confirmed that there is a high above-average concern for the state of the environment. The respondents showed the greatest concern in relation to air pollution due to traffic and the quality of basic foodstuffs, while the respondents were the least concerned about the provision of energy for different users.

A high, above-average score was also obtained on the Pollution Degree scale, which indicates that there is a high degree of pollution. The highest score, i.e. the highest degree of pollution, was obtained for the statements Assess the level of air pollution in your area and Assess the local pollution problem, and the lowest score was obtained for the statement Assess the level of water pollution in your area.

The fifth section of the questionnaire that was used in the research was related to environmental protection. When asked what environmental protection means to them, respondents most often chose the answers Condition of living standards and

preservation of quality of life and Responsibility towards new generations. In relation to solving the problem of pollution, according to the opinion of the respondents, we should solve these problems together, but a significant part of the respondents stated that it is the responsibility of the local self-government and the State, and only four of the respondents believe that solving this problem should also be the concern of the citizens. When it comes to the financing of environmental protection, according to the findings, that is, the respondents' opinion, finances should be allocated first of all by the State, and then by the Local Self-Government and the Environmental Protection Fund. As the most important environmental factors, the interviewees singled out first of all the greater number of pollution prevention measures and activities of the key factors responsible for the state of the environment and the construction of ecological infrastructure. In addition, respondents often chose Reducing the number of pollutants, as well as Efficient and numerous inspection.

The obtained findings also showed that, according to the opinion of the respondents, the biggest polluters of the environment are primarily People and Industry. A significantly smaller percentage of respondents chose answers such as Heating and power plants or Traffic. In addition, more than half of respondents believe that EU membership would contribute to environmental protection.

In addition to the examination of environmental problems and the respondents' awareness of environmental protection through these five sections, the research also dealt with a comparative analysis of the differences in the expressiveness of the scores in relation to the socio-demographic characteristics of the respondents: gender, age, level of professional education and place of residence. The obtained findings confirmed that statistically significant differences exist only in relation to the age of the respondents. Namely, significant differences were obtained for the EA and ACEP scales, and subsequent analysis showed that on the Environmental Activities scale, respondents aged 25 to 35 years had significantly lower scores compared to respondents aged up to 25 years, respondents aged 45 to 55 years and respondents older than 55 years. On the ACEP scale, it was confirmed that respondents aged 25 to 35 years old have significantly lower scores compared to respondents aged 35 to 45 years and respondents aged over 55 years. Also, on the scale of concern for environmental problems, it was confirmed that respondents aged 35 to 45 have significantly higher scores compared to respondents aged 45 to 55.

On the other scales, no statistically significant differences in the expressiveness of the scores in relation to the age of the respondents were confirmed. Significant differences were not confirmed either in relation to gender, level of professional education and place of residence of the respondents.

Conclusions

The aim of this research was to examine environmental problems and the level of awareness of respondents about environmental protection. In order to conduct the

research, a questionnaire consisting of five parts was created. The first four sections of the questionnaire refer to the examination of Environmental Activities, Assessment of the Environmental Condition, Assessment of Concern for Environmental Problems and Assessment of the State of Pollution. It is also important to note that all four scales showed good reliability above an arbitrary limit. The fifth section of the questionnaire refers to environmental protection, examining who is the biggest polluter and whose responsibility it is to implement and finance activities aimed at environmental protection. The obtained findings showed that the respondents have an above-average expression when it comes to the environmental activities they carry out. On the scale of the Environmental Status Assessment (EA), a grade slightly below the theoretical average was obtained, which could indicate that the situation is not hopeless, but that there is certainly room and need to improve. When it comes to the assessment of concern for environmental problems, it was confirmed that there is a high above-average concern for the state of the environment. A high, above-average score was also obtained on the Pollution Degree scale, which indicates that there is a high degree of pollution. In addition to the examination of environmental problems and the respondents' awareness of environmental protection through these five sections, the research also dealt with a comparative analysis of the differences in the expressiveness of the scores in relation to the socio-demographic characteristics of the respondents: gender, age, level of professional education and place of residence. Based on the analysis of the obtained results, it can be concluded that the respondents have an above-average expression when it comes to the environmental activities they carry out. The obtained findings confirmed that statistically significant differences exist only in relation to the age of the respondents. Such findings may also be a consequence of unevenness in the structure of the sample and it is very likely that they would be different if there was a better distribution in the categories of variables related to the socio-demographic characteristics of the respondents.

Acknowledgements

This scientific paper was created as part of the Scientific and Professional Project Circular Economy in the Function of Sustainable Development organized by the Educational and Business Center for Human Resource Development, Management and Sustainable Development from Novi Sad.

Conflict of interests

The authors declare no conflict of interest.

References

1. Agarwal, S. (2018). Environmental biotechnology. New Delhi: APH Publishing Corporation.
2. Carmi, N. (2013). Caring about tomorrow: Future orientation, environmental attitudes and behaviors. Environmental Education Research, 19(4), 430-444.

3. Environmental Awareness in Germany 2018: results of a representative survey, from:https://www.umweltbundesamt.de/en/publikationen/environmental-awareness-in-germany-2018

4. Fayyaz, S., Ali Lashari, A., Nandwani, Sh., Ali Chang, M. (2023). Assessing Environmental Awareness and Conservation Behavior in Schools for Sustainable Development. *Pakistan Journal of Humanities and Social Sciences, 11*(4), 4070–4081. DOI:10.52131/pjhss.2023.1104.0676

5. Handayani, W., Ariescy, R. A., Cahya, F. C., Islami Yusnindi, S., & Ari Sulistyo, D. (2021). Literature review: environmental awareness and proenvironmental behavior. *5th International Seminar of Research Month 2020. NST Proceedings*. 170-173. doi: 10.11594/ nstp.2021.0925

6. Hanisch, A., Rank, A., & Seeber, G. (2014). How green are European curricula? a comparative analysis of primary school syllabi in five European countries. European Educational Research Journal, 13(6), 661-682

7. Hidalgo-Crespo, J., Coello-Pisco, S., Reyes-Venegas, H., Bermeo-Garay, M., Amaya, J., Soto, M., & Hidalgo-Crespo, A. (2022). Understanding citizens' environmental concern and their pro-environmental behaviours and attitudes and their influence on energy use. Energy Reports, 8, 103-109. doi:https://doi.org/10.1016/j.egyr.2022.01.116

8. Ignjatović, J., Blagojević, M., Bajagić, M., & Rašković, V. (2024). Improvement of sustainable environment and economic competences using the E-academy for the developmet of rural areas. *Economics of Agriculture*, *71*(2) 453-468.

9. Iizuka, M. (2000). Role of Environmental Awareness in Achieving Sustainable Development, DOI: 10.13140/RG.2.1.3156.6484. Retrieved from: https://www.researchgate.net/publication/297733662

10. Jež Rogelj, M., Mikuš, O., & Hadelan L. (2024). Assesssment model for sustainable vrural development at nuts 3 level: a multi-criteria approach, *Economics of Agriculture, 71*(3), 755-773. https://doi.org/10.59267/ekoPolj2403755J

11. Jović, R., Vitković, B., & Nešić, A. (2024). The intersection of science and policy in sports safety. *Sport, media and business*, 10(1), 105-120. https://doi.org/10.58984/smb2401105j

12. Luković, M., Kostić, M., Dudić, B., Spalević, V., & Pantović, D. (2024). Perceptions of mountain ecosystem services in Golija-Studenica Biosphere Reserve, Serbia: latent transformation from sustainable towards regenerative tourism. *Journal on Protected Mountain Areas Research and Management*, 16, (2), 4-15. (M23) IF=0,4, https://doi.org/10.1553/eco.mont-16-2s4

13. Marjanović, N., Jovanović, V., Ratknić, T., & Paunković, Dž. (2019). The role of leadership in natural resource conservation and sustainable development- a case study of local self-government of Easter Serbia. *Economics of Agriculture, 66*(3), 889-903.

14. Milimo Dauti, M. (2014). An assessment of environmental awareness towards sustainable development among selected grade twelve pupils in Lusaka district, The University of Zambia, Lusaka. PhD these
15. Paparić, D., Glavaš, J., & Ravlić, S. (2024). Rural areas management and strategic development challenges with emphasis on sustainable island development. *Economics of Agriculture*, *71*(3), 871–894. https://doi.org/10.59267/ekoPolj2403871P
16. Premović, J. (2016). Characteristic of human resources in Serbian rural tourism. *Economics of Agriculture*, *63*(2), 633–647. https://doi.org/10.5937/ekoPolj1602633P
17. Premović, J. (2021). *Menadžment ljudskih resursa u turističkim preduzećima*, naučna monografija. Ekonomski institut Beograd. [*in English*: *Human resources management in tourism companies*, scientific monograph, Economic Institute Belgrade].
18. Premović, J., & Boljević, A. (2016). *The importance of environmental awareness for sustainable tourism development,* Book of Proceedings, ECIN 2016: International economics and management conference, Belgrade, Serbia.
19. Stojić, M., Pejović, B., & Bizić, V. (2024). Correlation between solvency of Serbian agricultural sector and investments in environmental responsibilities. *Economics of Agriculture*, *71*(2), 381-395.
20. Милтојевић, В., Живковић, С., & Илић-Крстић, И. (2011). Еколошка свест индивидуалних пољопривредних произвођача. *Economics of Agriculture, 58*(4), 777-793. [*in English*: Miltojević, V., Živković, S., & Ilić-Krstić, I. (2011). Environmental awareness of individual agricultural producers. *Economics of Agriculture, 58*(4), 777-793].

ORGANIZATION OF GREEN PROJECTS FOR THE PURPOSE OF PROMOTION AND SATISFACTION OF USERS IN RURAL REGIONS IN SERBIA

Asmaeil Ali Mohammed Khmaaj[1], Bojana Ostojić[2], Biljana Ilić[3], Milena Cvjetković [4], Jelena Ružić [5]

**Corresponding author E-mail: bojanaostojic85@gmail.com*

ARTICLE INFO

Original Article

Received: *28 November 2024*

Accepted: *15 January 2025*

doi:10.59267/ekoPolj2501189A

UDC 502.12:338.48-44(1-22) (497.11)

Keywords:

Green projects, digitalization of tourism services, customer satisfaction, rural areas, demographic differences.

***JEL**: Q56, M31, R11*

ABSTRACT

The presented study analyzes the impact of green initiatives and new technologies on the tourist experience and user satisfaction in rural areas of western Serbia, focusing on the differences between younger and older populations. Through regression and correlation analysis, it was found that sustainability, green mobility, and the digitalization of services significantly increase the satisfaction of young tourists, while older tourists prefer traditional values such as safety and comfort. The younger population reacts positively to innovations, while the older group seeks stability and practicality. The results suggest that further implementation of sustainable practices and technologies could transform the tourism offering in rural areas, and tailored marketing approaches could effectively address the specific needs of both demographic segments. It is recommended to strengthen the promotion of ecological and technological solutions as the key to future tourism growth in this region.

1 Asmaeil Ali Mohammed Khmaaj, doctorial student, Faculty of project management (PMC), Bozidara Jankovica Street 14, 11000 Belgrade , Serbia, Phone: +38162331077, E-mail: lakilee@yahoo.com, ORCID ID (https://orcid.org/0009-0002-0740-3948)

2 Bojana Ostojić, Associate professor, Faculty of Project Management (PMC), Bozidara Jankovica Street 14, 11000 Belgrade , Serbia, Phone: +381693370334, E-mail: bojanaostojic85@gmail.com, ORCID ID (https://orcid.org/0000-0001-6731-431X)

3 Biljana Ilić, Associate professor, Faculty of project management (PMC), Bozidara Jankovica Street 14, 11000 Belgrade , Serbia, Phone: +38162331077, E-mail: bilja0110@gmail.com, ORCID ID (https://orcid.org/0000-0001-6137-8478)

4 Milena Cvjetković, Associate professor, Faculty of engineering management, Bulevar vojvode Mišića 43, 11000 Belgrade, Serbia, Phone: +381641887873, E-mail: cvjetkovicm@gmail.com, ORCID ID (https://orcid.org/0000-0002-9677-7089)

5 Jelena Ružić, Assistant, Faculty of project management (PMC), Bozidara Jankovica Street 14, 11000 Belgrade, Serbia, Phone: +381621791924, E-mail: jruzic45@gmail.com, ORCID ID (https://orcid.org/0009-0000-4715-2288)

Introduction

The social sciences address a wide range of topics within the scope of analyzing how to enhance agriculture and the countryside (Sotiropoulos, 2014). The topic of how to attain the presumed social growth and the main regions, types, directions, and boundaries of social changes and development are implied in any discussion of social development (Šljukić & Šljukić, 2019). It examines subjects that essentially put into question many facets of human civilization and culture. The modernization of agriculture and attempts at sectoral and centralist management and influence on rural development are examples of how rural development, a long-term and intricate process, was unjustly reduced for a long time to a simplified economic-agrarian matrix in both theory and development practice (Shucksmith, 2010). Shortal (2004) argues that the notion that social development is a result of technical development—that is, simplified—as a result of economic growth is one of the factors contributing to the reduction of rural to agricultural development.

However, the reality is also inverse: economic growth and technical-technological advancement are only a few facets of rural development, and social development is a prerequisite for technical-technological development. A limited economic understanding of development (modernization of agriculture, technical and technological advancement, growth of productivity, efficiency, etc.) is less comprehensive than the social ramifications of the interplay of natural, technological, economic, social, and institutional factors (Renting et al., 2008).

Nieto Masot & Gurría Gascón (2024) claim that the unequal distribution of land and its production, low wages, and persistent underemployment with a constantly declining and less diverse workforce have led to significant emigration and the abandonment of rural communities. For this reason, rural development seeks to both develop the "rural" and promote its value and contributions to society at large. Rural development must rely on internal forces and resources (existing or constructed) in order to avoid dictated and dependent development. These forces and resources, when combined with external ones, should serve as the foundation for sustainable socio-economic growth and development (Ilić et al., 2024a).

A variety of sectoral, global, regional, and local policies that are interrelated and conditional - some of which may even be partially opposed - are necessary to attain these aims; one policy is neither feasible nor adequate (Ilić et al., 2024b; Dašić et al., 2024). The authors of the paper want to look into ways to support the development of rural areas, i.e., rural areas, with a proper assessment of attitudes modern consumers, that is, service users, have. This is because Serbia is rich in natural resources, clean water, healthy air, and, most importantly, a healthy environment, and rural regions are actually less developed.

The aging of the population and increased youth exodus from Serbia pose a threat to the country. By analyzing the perspectives of those younger generations, the paper seeks to shed light on the factors and attitudes of those individuals, making them more likely to

visit and possibly even reside in rural areas. The focus of the research are the villages of the Western part of Serbia, more precisely the villages located in the Zlatibor district (Zlatibor mountain), namely: Mokra Gora, Gostilje, Zlakusa, Kremna, Sirogojno and Radoinja. Statistical crossover of green project characteristics with promotion and user satisfaction variables is the methodology used in this article. Eco-tourism, organic tourism, sustainable energy, green mobility, and the digitization of tourism services are examples of green project factors. Marketing channels, service quality, comfort and safety, and customer loyalty and trust are all factors that affect customer happiness and promotion. The research is more comprehensive because each of the variables has four additional sub-variables that cross over with one another. The author's goal is to investigate the views of service consumers, namely the younger generations, who have an impact on the higher attendance of villages, or rural areas, in this section of the nation.

Literature Review

Since rural areas are the main resource for society and should be characterized positively, research and development in these areas is of crucial importance for all societies. This suggests that rural areas and their resources should be viewed as potentially significant for the entire community (Masot & Gascon, 2021). A thorough understanding of the close relationship between the countryside and the city, the mutual conditions required for their development (as well as the development of society as a whole), their functions, the resources they can complement and the needs they can meet is crucial.

The concept of rural development in EU countries was analyzed by Adamovicz & Zvolinska-Ligaj (2018), together with its relationship to the development of the common agricultural policy and the change of the cohesion strategy. Janković (2020) asserts that the sociological component of research encompasses rural social reality and examines global society as well as pertinent social factors, phenomena, and processes that may impact rural areas.

The focus is on social capital, social networks, and people's involvement in local community social relations. Analyzing the reciprocal influence of pertinent social events and processes is implied by the sociological approach. Simultaneously, this approach is an attempt to offer a theoretical-methodological framework for understanding rural areas' social development, which would provide a more thorough and meaningful explanation of factors that can affect the process of rural development as well as fundamentally significant social phenomena (Bruckmeier & Tovey, 2008). According to Long (1977), the study of social aspects of rural development should be based on the notion that social processes underpin development are widely understood. This is highlighted by the examination of social capital, population participation in local communities, and social networks, including modern aspects as stated by Janković (2020). Stated differently, the social approach is the process of bringing the local population together to accomplish goals that are relevant to the community's growth and the enhancement of the quality of life in the (rural) social space (Ilic, 2019; Pantović et al., 2025). The intricacy of rural development as a multifaceted, long-term process with

numerous dimensions, actors, and interests must be considered in order to approach it appropriately. It is important to view Serbian villages as projects whose execution will benefit not only the local communities but also, more generally, Serbian society as a whole. These projects can be classified as green projects or sustainable development projects since they deal with situations (areas) where it is crucial to maintain pristine natural conditions.

In addition to generating financial gain, their realization improves human well-being and lessens adverse environmental effects (Djukic & Ilic, 2024; Ilic, 2022; Zolak, 2024). In addition to sectoral policies, territorial policies - particularly promotion strategies and regional (and local) rural development policies - can also help Serbia's rural areas grow. This demonstrates the significance of established local self-government, robust social capital, social networks, and local population engagement in community life (Ilic et al., 2022). Due to regional development disparities and the need to delegate some responsibility for rural area development to local self-governments and regions, with prior strengthening of their "capacity" in a decentralized sense, the development of rural regions is crucial in Serbia. For many years, Serbia's agrarian policy has been highly unstable and unable (both financially and otherwise) to meet the demands of the country's domestic agricultural development (Ilić et al., 2020). Rural policies are essentially nonexistent in this regard, or they simply represent a minor addition to the agrarian policy

In order to create territorial policies for the development of Serbia's rural areas, it is important to fortify the idea of rural policy, which, in conjunction with agrarian policy, would coordinate and unite the development efforts of other sectors. The younger population, or future generations of young people who would visit the rural areas more frequently, would be impacted by Serbia's rural areas being strengthened and properly promoted. It is important to examine the views and perspectives of younger generations regarding villages and rural regions in general, as they have their own wants and desires.

Generation Z encompasses the younger population born between the late 1990s and the mid-2010s and is unique in that it grew up in the digital age. From an early age, these young people were exposed to rapid technological advancements, shaping their habits and ways of thinking. The availability of the internet, mobile phones, and various digital platforms allowed them to become "digital natives", with an exceptionally developed ability to use technology. In contrast to previous generations, who first adopted traditional media such as television and print publications, Generation Z focuses more on digital media, especially social networks and video content (Thiele, 2011).

One of the main characteristics of this generation is their distinct skill in quickly accessing and processing information. They are accustomed to constant data exchange and have the ability to rapidly assess the relevance of information. This makes them highly effective in dynamic environments that require quick responses and adaptability to new situations (Brown & Duguid, 2001). Their communication habits and learning styles are drastically different from earlier generations, making them particularly interesting for research in the context of businesses and organizations that demand innovation.

Moreover, Generation Z is marked by a strong desire for individuality and authenticity. In both their personal and professional lives, they seek to express themselves as individuals with unique skills and interests, rather than just as part of a larger collective. When it comes to work, they are more focused on flexibility and the use of technology to increase productivity. Rigid work structures and fixed schedules are unappealing to this generation, who values the ability to work remotely and in environments that foster creativity and innovation (Nicholas & Steyn, 2020).

Materials and methods

The research presented in this paper was conducted from May to August 2024, focusing on users of tourism services in rural areas of western Serbia, specifically in the following villages: Mokra Gora, Gostilje, Zlakusa, Kremna, Sirogojno and Radoinja. A total of 235 respondents participated in the study. The structure of the respondents included 48% male and 52% female participants, as well as 31% younger and 69% older population, with 65% being domestic and 35% foreign tourists.

Data were collected through an online questionnaire. In addition to basic respondent information, the questionnaire was divided into two sections. The first section assessed variables related to green projects and new technologies, including eco-tourism, organic tourism, sustainable energy, green mobility, and the digitalization of tourism services. The eco-tourism variable evaluates how eco-friendly practices, such as environmentally sustainable accommodations and tourist education on nature preservation, are encouraged. The organic tourism variable assesses the promotion of organic products and sustainable agricultural practices through farm visits, events, and educational activities. The sustainable energy variable evaluates the implementation of renewable energy sources in tourist facilities and their benefits for tourists and the community. Green mobility focuses on the development of infrastructure and the promotion of eco-friendly transport options, such as electric bicycles and vehicles. The digitalization of tourism services includes technological solutions like online bookings, virtual tours, and mobile apps that enhance the tourist experience.

The second section of the questionnaire aimed to explore respondents' attitudes toward the promotion of services and satisfaction with the offerings in the analyzed rural areas. The effectiveness of various marketing channels, such as social media, websites, and email campaigns, in promoting the destinations was evaluated through the marketing channels variable. User satisfaction with services, including staff friendliness, facility quality, and service efficiency, was assessed through the service quality variable. The safety and comfort variable evaluated the perception of safety, access to emergency services, and accommodation comfort during the stay. The user trust variable explored how users perceive the brand reputation, transparency of information, and quality of customer support. The customer loyalty variable assessed users' motivation to revisit, the effectiveness of loyalty programs, and their willingness to recommend the destination to others. Respondents rated these variables on a scale of 1 to 7, where they expressed their level of agreement with the statements in the survey, from strong disagreement to full agreement.

The aim of the research is to analyze the impact of green projects and new technologies on the promotion and satisfaction of users in rural areas of Serbia, with a particular focus on younger and older tourist populations. The research will explore how sustainable tourism, organic tourism, sustainable energy, green mobility, and digitalization of tourism services affect the tourist experience, their attitudes toward safety, comfort, service quality, and loyalty to destinations. Additionally, the study will examine the effectiveness of promotion through various marketing channels and its correlation with user satisfaction and trust.

The subject of this research includes green projects and new technologies in tourism, particularly in the context of eco-tourism, organic tourism, sustainable energy, green mobility, and the digitalization of services, as well as their impact on promotion, service quality, safety, comfort, trust and customer loyalty. The research is focused on understanding how these initiatives affect the perceptions and experiences of tourists visiting rural areas of Serbia, considering the differences in responses between younger and older populations.

The research tests the following hypotheses:

- H1: There is a positive correlation between the implementation of green projects and overall tourist satisfaction in rural areas of Serbia.
- H2: There are statistically significant differences in the correlation between the variables of green projects and new technologies and the variables of promotion and user satisfaction, with respect to the younger and older populations.
- H3: The younger tourist population shows a higher level of engagement and satisfaction with the digitalization of tourism services (online bookings, mobile apps) compared to the older population.

The collected data were processed using the IBM SPSS Statistics 25 software. Through this software, descriptive statistics, correlation, and regression analyses were performed. The interpretation of the results served to confirm the hypotheses set out in this research.

Results

Initially, descriptive statistics were performed on the analyzed variables. The descriptive statistics displayed the minimum, maximum, and mean values of the analyzed variables, as well as the deviation from the mean, i.e., the standard deviation. Table 1 presents the abbreviations of the variables that will be used in the subsequent analysis.

The descriptive statistics of the variables related to green projects, new technologies, and promotion and user satisfaction provide an insight into the general attitudes and preferences of the respondents regarding different aspects of tourism. Since all the variables were evaluated on a scale from 1 to 7, the mean values and standard deviations allow us to analyze how the responses behave and whether there is variation in the respondents' opinions.

Table 1. Descriptive Statistics of the variables Green Projects and new Technologies and Promotion and User Satisfaction

Variable	Mark	N	Min	Max	Mean	Standard Deviation
Eco-tourism	ZPT1	235	1	7	4,57	1,761
Organic tourism	ZPT2	235	1	7	4,53	1,781
Sustainable energy	ZPT3	235	1	7	4,49	1,610
Green mobility	ZPT4	235	1	7	4,54	1,752
Digitalization of tourist services	ZPT5	235	1	7	4,51	1,886
Marketing channels	PZK1	235	1	7	4,89	1,715
Service quality	PZK2	235	1	7	4,66	1,884
Safety and comfort	PZK3	235	1	7	4,76	1,647
Customer trust	PZK4	235	1	7	5,05	1,751
Customer loyalty	PZK5	235	1	7	5,01	1,872

Source: Author's research

For green projects and new technologies, the mean values of the variables range from 4,49 to 4,57. The highest mean value is found for the variable eco-tourism (4,57), indicating that the respondents have a relatively positive, but not entirely enthusiastic, opinion about ecological practices in tourism. Following this, the variables organic tourism (4,53) and green mobility (4,54) suggest that respondents somewhat agree with the concepts of sustainable tourism in terms of organic farming and eco-friendly transportation options, but there is still room for improvement. The variable sustainable energy (4,49) has the lowest mean value among the analyzed variables in this group, which could suggest that respondents are not entirely convinced about the effectiveness and importance of using renewable energy sources in the tourism industry. The digitalization of tourism services (4,51) also has a mean value indicating that respondents are moderately satisfied with the application of digital tools in the tourism industry, but there are variations in opinions about their effectiveness.

The standard deviations of these variables indicate moderate to high variation in the responses of the respondents. The variable digitalization of tourism services has a high standard deviation of 1,886, suggesting that the respondents' opinions about digitalization are quite varied. Similar levels of variation are seen in the variables organic tourism and green mobility, where standard deviations of 1,781 and 1,752 indicate that respondents have different views and experiences with these practices. The variable sustainable energy has a standard deviation of 1,610, indicating some but less significant differences in respondents' views on this topic.

When considering the variables related to promotion and user satisfaction, the mean values indicate a somewhat higher level of satisfaction. The variables customer trust (5,05) and customer loyalty (5,01) have the highest mean values. Respondents are relatively satisfied with the services provided and demonstrate a good level of trust and loyalty towards the destinations and tourism services, as the mean values of these variables exceed 4,5. The variables service quality (4,66) and safety and comfort (4,76) have moderately positive values, suggesting that most respondents assess the service and safety in tourism as satisfactory, but there is still room for improvement.

The standard deviations for these variables also indicate significant variability in responses. The variable customer loyalty has a standard deviation of 1,872, meaning that opinions on loyalty vary considerably among respondents. Similar values were observed for the variables customer trust (1,751) and service quality (1,884), suggesting that there are differences in opinions here as well. Meanwhile, the variable safety and comfort has a standard deviation of 1,647, which is somewhat lower, but still indicates that not all respondents had the same experience regarding safety and comfort during their visit to the analyzed tourist destinations.

Table 2. Correlation values between the variables of green projects and new technologies and variable promotion and user satisfaction

	ZPT1	**ZPT2**	**ZPT3**	**ZPT4**	**ZPT5**
PZK1	,451**	,338**	,432**	,472**	,569**
PZK2	,437**	,229**	,534**	,509**	,544**
PZK3	,414**	,274**	,518**	,585**	,542**
PZK4	,359**	,202**	,535**	,543**	,515**
PZK5	,281**	,245**	,540**	,518**	,502**

**. The correlation is significant at the 0.01 level (2-tailed).

Source: Author's research

The strongest correlation among the analyzed variables is between green mobility (ZPT4) and safety and comfort (PZK3), with a correlation value of 0,585. This connection suggests that tourists who rate green mobility, such as electric bicycles and cars, as an important factor in tourism, simultaneously perceive destinations as safe and comfortable. This implies that eco-friendly transportation not only contributes to sustainability but also enhances the tourists' sense of safety and comfort, positively shaping their overall experience.

The next strongest correlation is between the digitalization of tourism services (ZPT5) and marketing channels (PZK1), with a correlation of 0,569. This correlation shows that tourists who use digital tools for bookings and planning often recognize the effectiveness of marketing through social media, websites, and email campaigns, emphasizing the importance of digital presence in promoting tourism services.

Additionally, there is a significant correlation between sustainable energy (ZPT3) and service quality (PZK2), with a correlation value of 0,534. This relationship suggests that tourists who experience the benefits of using renewable energy sources often rate the service quality more positively, indicating that eco-friendly practices can enhance the overall impression of the services offered to tourists.

On the other hand, the variables with the lowest correlations include organic tourism (ZPT2) and user trust (PZK4), with a correlation of 0,202, indicating a weaker connection between these two factors. While organic tourism may be recognized as important, it is not directly linked to users' perception of trust in the brand and services, which may suggest that other factors, such as brand reputation and customer support quality, play a key role in building trust.

The next weaker correlation is between organic tourism (ZPT2) and user loyalty (PZK5), with a correlation value of 0,245. This result suggests that, while organic tourism is an interesting segment, it is not strongly connected to users' willingness to return to the same destination or recommend it to others. The correlation between eco-tourism (ZPT1) and user loyalty (PZK5) is 0,281, indicating that, although eco-tourism can increase tourist engagement, it is not strongly linked to their long-term loyalty.

Table 3. Regression model of the impact of independent variables of promotion and user satisfaction on dependent variables of green projects and new technologies (only variables that achieved statistical significance are shown)

Dependent	Independent	β	t	Sig.	R^2	F	Sig.
PZK1	ZPT1	,182	3,084	,002	,422	33,498	,000
	ZPT5	,345	5,351	,000			
PZK2	ZPT1	,180	3,091	,002	,434	35,131	,000
	ZPT3	,258	4,152	,000			
	ZPT5	,255	3,995	,000			
PZK3	ZPT3	,195	3,193	,002	,457	38,504	,000
	ZPT4	,297	4,627	,000			
	ZPT5	,218	3,484	,001			
PZK4	ZPT3	,266	4,213	,000	,415	32,477	,000
	ZPT4	,250	3,766	,000			
	ZPT5	,209	3,222	,001			
PZK5	ZPT3	,302	4,721	,000	,400	30,584	,000
	ZPT4	,231	3,428	,001			
	ZPT5	,213	3,248	,001			

Source: Author's research

Based on the regression analysis, we can identify which independent factors from the field of green projects and new technologies make the most important contribution to the dependent variables related to promotion and user satisfaction. The β values (standardized coefficients), along with the t and sig. values, help to understand the strength and significance of each individual impact.

For marketing channels (PZK1), the most significant contribution comes from ZP5 (digitalization of tourism services), with a coefficient of β = 0,345 and a t value of 5,351, indicating a very high and statistically significant impact (p = 0,000). Additionally, ZP1 (eco-tourism) makes a significant contribution with β = 0,182 (t = 3,084, p = 0,002). The overall model explains 42,2% of the variance in the dependent variable PZK1, with an F value of 33,498 (p = 0,000), indicating that all the independent factors are significantly related to marketing channels. For service quality (PZK2), the largest contribution comes from ZP3 (sustainable energy), with β = 0,258 and t = 4,152 (p = 0,000), demonstrating a strong connection between sustainable energy and the perception of service quality. Also, ZP5 (digitalization of tourism services) and ZP1 (eco-tourism) have similar contributions with β = 0,255 and β = 0,180 (t values of 3,995 and 3,091, p = 0,000 and p = 0,002, respectively). The model for PZK2 explains 43,4% of the variance (F = 35,131, p = 0,000), indicating that sustainable energy and digitalization have a significant impact on

service quality. For the variable safety and comfort (PZK3), the strongest contribution comes from ZP4 (green mobility) with β = 0,297 (t = 4,627, p = 0,000), followed by ZP5 (digitalization of tourism services) with β = 0,218 (t = 3,484, p = 0,001). The model for PZK3 explains 45,7% of the variance, suggesting that green mobility and digitalization play an important role in shaping tourists' perception of safety and comfort. When it comes to user trust (PZK4), the most significant contribution comes from ZP3 (sustainable energy) with β = 0,266 (t = 4,213, p = 0,000), followed by ZP4 (green mobility) and ZP5 (digitalization of tourism services) with β = 0,250 and β = 0,209 (t values of 3,766 and 3,222, p = 0,000 and p = 0,001, respectively). The overall model for PZK4 explains 41,5% of the variance (F = 32,477, p = 0,000), indicating a strong influence of these variables on user trust. For user loyalty (PZK5), the largest contribution comes from ZP3 (sustainable energy) with β = 0,302 (t = 4,721, p = 0,000), followed by ZP4 (green mobility) with β = 0,231 (t = 3,428, p = 0,001), and ZP5 (digitalization of tourism services) with β = 0,213 (t = 3,248, p = 0,001). The model for PZK5 explains 40,0% of the variance, with an F value of 30,584 (p = 0,000), confirming that sustainable energy, green mobility, and digitalization significantly affect user loyalty.

The variables that made the largest individual contributions to the dependent variables are ZP3 (sustainable energy), ZP4 (green mobility), and ZP5 (digitalization of tourism services). These variables have the largest standardized coefficients (β) relative to the other independent variables, indicating their significant impact on dependent variables such as marketing channels, service quality, safety and comfort, user trust, and user loyalty.

A correlation analysis was conducted between the green projects and new technologies variables and the promotion and user satisfaction variables, from the perspective of both younger and older populations as users of tourism services in the analyzed rural areas. The correlation results are shown in Table 4.

Table 4. Correlation values between green projects and new technologies variables and promotion and user satisfaction variables from the perspective of the age population of users

		ZPT1	ZPT2	ZPT3	ZPT4	ZPT5
Younger population	**KL1**	,405**	,220*	,521**	,418**	,295**
	KL2	,421**	,111	,575**	,317**	,290**
	KL3	,218*	,088	,522*	,311*	,227**
	KL4	,120**	,192	,599**	,362**	,392*
	KL5	,135*	,138	,150**	,352*	,220**
	N	73	73	73	73	73
Older population	**KL1**	,571**	,394**	,457**	,534**	,589**
	KL2	,457**	,310**	,541**	,537**	,523**
	KL3	,584**	,431**	,545**	,561**	,591**
	KL4	,390**	,292*	,527**	,507**	,483**
	KL5	,337**	,319**	,543**	,475**	,462**
	N	162	162	162	162	162

**. The correlation is significant at the 0,01 level (2-tailed).

*.Correlation is significant at the 0,05 level (2-tailed).

Source: Author's research

The correlation between the analyzed variables for the younger and older populations shows clear differences in perception and engagement regarding green projects and new technologies in tourism. In the younger population, correlations between variables such as sustainable energy, green mobility, and digitalization of tourism services and user satisfaction factors are positive, but not as strong as in the older group. While younger respondents recognize the importance of ecological and digital solutions, they are less likely to directly connect them to their experience and satisfaction during their stay. The correlation between ZP2 (organic tourism) and KL2 (service quality) in the younger population is relatively weak (0,111), suggesting a smaller impact of these factors on their views of service quality in tourism.

On the other hand, the older population shows significantly stronger and more frequent correlations between green initiatives and technological factors with user satisfaction. The correlation between ZP5 (digitalization of tourism services) and KL3 (safety and comfort) is 0,591, indicating that older respondents strongly associate the use of digital tools with a greater sense of safety and comfort during their stay. Additionally, ZP3 (sustainable energy) and KL5 (user loyalty) have a correlation of 0,543, suggesting that older tourists who value sustainable energy practices also exhibit higher loyalty to destinations that implement ecological initiatives. These differences highlight that the older population more frequently recognizes the impact of green and technological innovations on the overall tourism experience, while younger tourists may be less engaged with the ecological and sustainable aspects of tourism, focusing more on factors such as price or the popularity of the destination.

Given these differences, it is clear that marketing strategies should be tailored to the specific characteristics of each group. Younger populations should be provided with a stronger focus on digital tools and technologies that enable a faster and more efficient experience, while older populations should be emphasized on the importance of ecological practices and the benefits these practices bring in terms of safety and comfort.

Discussions

The results of this research provide valuable insight into the connections between the application of green projects, new technologies, and overall tourist satisfaction, as well as the differences in perceptions and engagement between younger and older populations. In accordance with the first hypothesis, the research confirms the existence of positive correlations between the implementation of green initiatives (such as eco-tourism, organic tourism, sustainable energy, green mobility, and digitalization) and overall tourist satisfaction in rural areas of Serbia. Based on the obtained results, it can be concluded that ecological and sustainable initiatives have a significant impact on tourists' perceptions and their satisfaction levels during their stay. The correlation between ZP3 (sustainable energy) and PZK3 (safety and comfort) is 0,585, which suggests that tourists staying in destinations that use renewable energy sources often experience greater safety and comfort, improving their overall impression of the destination and increasing their satisfaction. Similar results were found for other

variables, such as green mobility and the digitalization of tourism services, which also have a positive effect on the overall tourist experience. For example, the use of mobile applications for booking and other digital platforms can contribute to greater efficiency and accessibility of information, boosting tourist engagement and their overall impression of the destination.

The second hypothesis, which relates to the existence of statistically significant differences in correlations between green projects and new technologies in promotion and user satisfaction from the perspective of younger and older populations, was also confirmed. The research showed that the older population exhibits significantly stronger correlations between green initiatives and user satisfaction compared to the younger population. The correlation between the variables ZP5 (digitalization of tourism services) and KL5 (user loyalty) for the older population is 0,543, while for the younger population, this value is lower. This finding indicates that older tourists are more likely to recognize the value of technological innovations as key factors contributing to their satisfaction and loyalty. Given their experience, the older population is more willing to acknowledge the usefulness of digitalization and its impact on the quality of tourism services, such as online reservations and easier access to information. On the other hand, younger populations tend to focus more on other aspects of the tourism experience, as reflected in the weaker connection between green initiatives and satisfaction factors. While younger tourists recognize the importance of sustainability, they often place less emphasis on ecological initiatives compared to older populations, confirming the thesis that their preferences and motivations for engagement in tourism are more closely tied to digital technologies.

The third hypothesis, which claims that the younger population of tourists demonstrates a higher degree of engagement and satisfaction with the digitalization of tourism services, especially through tools like online reservations and mobile applications, was also confirmed. Younger tourists show a greater degree of engagement with digital tools and value the efficiency and accessibility of information online, as seen in the high correlation between ZP5 (digitalization of tourism services) and PZK1 (marketing channels) in the younger population (0,569). This finding confirms that younger tourists have a higher level of technological literacy and are more willing to use digital tools to enhance their tourism experience, such as mobile phone apps and online reservation platforms. In comparison with the older population, who is less engaged in using digital technologies, younger tourists place digital presence and online interaction at the center of their tourism engagement. The lower correlations in the older population suggest that the use of digital tools is less prevalent among them, and their satisfaction is more closely linked to traditional elements of the tourism experience, such as ecological initiatives and sustainable approaches.

The obtained results highlight a clear need for a differentiated approach in promoting tourism services, taking into account demographic differences in engagement and preferences among tourists. Younger tourists value digital technologies and service efficiency more, while older tourists show a greater inclination to value ecological

initiatives and sustainability as key factors for their satisfaction. These differences emphasize the importance of adapting marketing and promotional strategies to ensure engagement and satisfaction for all groups of tourists.

Conclusions

The results of this research clearly show that there is a significant connection between the application of green projects and overall tourist satisfaction in rural areas of Serbia. Ecological initiatives and new technologies positively impact the tourist experience, with the older population showing a greater tendency to recognize the value of these factors in their satisfaction, while the younger population values the digitalization of tourism services more. This research confirms the existence of statistically significant differences between the younger and older populations in their perception and engagement with green projects and new technologies. Therefore, for the future development of tourism in rural areas of Serbia, it is necessary to focus promotion and marketing strategies to account for the specific needs and preferences of different demographic groups.

This research has several limitations. First, it was conducted in rural areas of Serbia, which may limit the applicability of the results to urban areas or other countries with different tourism practices. Another challenge is the sample size, which may affect the statistical power of the research. Additionally, the collected responses from participants may be subject to subjective biases, which could influence the accuracy of the results. The study did not consider specific types of green projects, so a more detailed analysis of individual factors could provide further insights.

Future research could focus on several key directions. It is recommended to expand the research to urban areas and international populations to observe regional and cultural differences in the perception of green initiatives and new technologies. Furthermore, a more detailed analysis of specific green projects, such as sustainable energy or ecological services, could help identify the factors that most influence tourist satisfaction. The research could also be extended to examine marketing strategies and the impact of various communication channels (digital vs. traditional) on the engagement of younger and older populations. Future research directions could focus on developing specific strategies to improve tourist engagement through digital tools, especially among younger tourists, and on the role of sustainability education in enhancing the tourist experience.

Conflict of interests

The authors declare no conflict of interest.

References

1. Adamowicz, M., & Zwolińska-Ligaj, M. (2018). New concepts for rural development in the strategies and policies of the European Union. Economic and Regional Studies/*Studia Ekonomiczne i Regionalne, 11*(3), 7-31

2. Brown, J. S., & Duguid, P. (2001). The social life of information. Harvard Educational Review, 71(1), 151-152.
3. Bruckmeier, K., & Tovey, H. (2008). Knowledge in sustainable rural development: From forms of knowledge to knowledge processes. *Sociologia ruralis, 48*(3), 313-329
4. Djukic, G. P. & Ilic, B. S. (2024). Significance of Methodological Management Principles for Infrastructural Economic Development Projects. In N. Baporikar (Ed.), *Infrastructure Development Strategies for Empowerment and Inclusion* (pp. 363-385). IGI Global. https://doi.org/10.4018/979-8-3693-2917-7.ch017;
5. Dašić, D., Vitković, B., & Borojević, K. (2024). The role of communication management in the development of rural areas. *Ekonomika Poljoprivrede*, *71*(4), 1421–1435. https://doi.org/10.59267/ekoPolj24041421D
6. Ilić, B., Stanković, S., & Ostojić, B. (2024a). Key factors of promoting innovative performance in agrobusiness SMEs: Project an empirical method. *Economics of Agriculture, 71*(1), 135-154
7. Ilić, B., Stanković, S., & Barjaktarović, M . (2024b). Measuring the impact of green finance on poverty reduction: Project of an empirical method. *International Journal of Applied Sciences & Development, 3*(3), 20-27. DOI: 10.37394/232029.2024.3.3
8. Ilic, B. S. (2022). Poverty and Poverty Indicators in the Republic of Serbia: The Impact of Uneven Regional Development. In N. Baporikar (Eds.), *Handbook of Research on Global Institutional Roles for Inclusive Development* (pp. 261-284). IGI Global. https://doi.org/10.4018/978-1-6684-2448-3.ch014
9. Ilic, B., Andjelic, S., Nikolic, M. (2022). Ecotourism and the importance of human resources. *Ecologica 29*(108), 539-547
10. Ilić, B., Đukić, G., & Balaban, M. (2020). Sustainable development directions of rural tourism of Timok region. *Economics of Agriculture 67*(1), 157-174). https://cyberleninka.ru/article/n/sustainable-development-directions-of-rural-tourism-of-timok-region
11. Ilic, B. S. (2020). Social Component of Sustainable Development and Quality of Life: Region of the Balkans, Eastern Serbia. In U. Akkucuk (Ed.), *Handbook of Research on Creating Sustainable Value in the Global Economy* (pp. 452-462). IGI Global. https://doi.org/10.4018/978-1-7998-1196-1.ch026
12. Janković, D. (2020). *Društvene promene i ruralni razvoj*. Poljprivredni fakultet Novi Sad, Serbia
13. Long, N. (1977). *An introduction to the sociology of rural development (ix+221pp.).* Tavistock Publications Limited., London, UK
14. Masot, A. N., & Gascón, J. L. G. (2021). Sustainable Rural Development: Strategies, Good Practices and Opportunities. *Land, 10*(4), 366
15. Nieto Masot, A., Gurría Gascón, J.L. (2024). Sustainable Rural Development: Strategies, Good Practices and Opportunities (Second Edition). *Land, 13*(1):104. https://doi.org/10.3390/land13010104
16. Nicholas, J. M., & Steyn, H. (2020). Project management for engineering, business and technology. Routledge.

17. Pantovic, D. ., Parausic, V. ., Radosavljevic, K. ., & Mihailovic, B. . (2025). Rural tourism and local authority satisfaction: Social, economic, and environmental effects. *Journal of Tourism Management Research*, 12(1), 17–26. https://doi.org/10.18488/31.v12i1.4088

18. Renting, H., Oostindie, H., Laurent, C., Brunori, G., Barjolle, D., Jervell, A.M., Granberg, L. And Heinonen, M. (2008). Multifunctionality of agricultural activities, changing rural identities and new institutional arrangements. *International Journal of Agricultural Resources, Governance and Ecology, 7* (4/5), 361-385

19. Shortal, S. (2004). Social or economic goals, civic inclusion or exclusion ? An analysis of rural development theory and practice. *Sociologia Ruralis, 44* (1), 109-123

20. Shucksmith, M. (2010). Disintegrated Rural Development? Neo-endogenous Rural Development, Planning and Place-Shaping in Diffused Power Contexts. *Sociologia Ruralis, 50* (1), 1-14.

21. Sotiropoulos D. A. (2014). Positive and negative social capital and the uneven development of civil society in Southeastern Europe. *Southeast European and Black Sea Studies, 5*(2), 243-256.

22. Thiele, L. P. (2011). Sustainability. Cambridge, UK: Polity Press.

23. Šljukić, S. i M. Šljukić (2019). Sociološki dometi Sretena Vukosavljevića. Zbornik abstrakata *III Naučni skup Teorija i praksa agrara u istorijskoj perspektivi* (p. 43). Centar za agrarnu istoriju. Poljoprivredni fakultet Novi Sad.

24. Zolak, V. (2024). The role of the media in creating the image of a tourist destination. *Sport, media and business*, *10*(1), 25-44. https://doi.org/10.58984/smb2401025z

DEMOGRAPHIC ANALYSIS OF THE AGRICULTURAL POPULATION OF SERBIA

Reka Korhecz[1], Marko Vladisavljević[2], Otilija Sedlak[3], Aleksandra Marcikić Horvat[4], Jelica Eremić Đodić[5]

**Corresponding author E-mail: reka.korhec@ef.uns.ac.rs*

ARTICLE INFO

Original Article

Received: *28 November 2024*

Accepted: *15 January 2025*

doi:10.59267/ekoPolj2501205K

UDC 314.9:316.334.55(497.11)

Keywords:

Demography, Agriculture, Serbia, Regression Analysis

***JEL**: J43, J11, C21*

ABSTRACT

The paper explores employment trends and demographic characteristics within Serbia's agricultural sector. Utilizing data from the Statistical Office of the Republic of Serbia and applying descriptive statistics and Probit regression analysis, the research examines key factors such as gender, age, education, region, and settlement type that influence employment in agriculture. The findings reveal a declining share of agriculture in total employment, accompanied by high rates of informal work and an aging workforce, with minimal participation from younger generations. The study highlights the need for urgent measures to rejuvenate the workforce, promote youth involvement, and formalize employment. Key recommendations include developing educational and financial support programs for young farmers, modernizing agricultural practices, and implementing rural development strategies to ensure the sector's long-term sustainability and growth.

1 Reka Korhecz, teaching assistant, University of Novi Sad, Faculty of Economics in Subotica, Segedinski put 9-11, 24000 Subotica, Serbia, Phone: +381 24 628000, E-mail: reka.korhec@ef.uns.ac.rs, ORCID ID (https://orcid.org/0009-0009-7343-9990)

2 Marko Vladisavljević, assistant professor, University of Belgrade, Faculty of Economics, Kamenička 6, 11000 Belgrade, Serbia, Phone: +381 24 628000, E-mail: marko.vladisavljevic@ekof.bg.ac.rs, ORCID ID (https://orcid.org/0000-0001-6020-1355)

3 Otilija Sedlak, full professor, University of Novi Sad, Faculty of Economics in Subotica, Segedinski put 9-11, 24000 Subotica, Serbia, Phone: +381 24 628017, E-mail: otilija.sedlak@ef.uns.ac.rs, ORCID ID (https://orcid.org/0000-0002-7430-7027)

4 Aleksandra Marcikić Horvat, associate professor, University of Novi Sad, Faculty of Economics in Subotica, Segedinski put 9-11, 24000 Subotica, Serbia, Phone: +381 24 628027, E-mail: aleksandra.marcikic.horvat@ef.uns.ac.rs, ORCID ID (https://orcid.org/0000-0002-4199-4238)

5 Jelica Eremić Đođić, associate professor, University Educons, Vojvode putnika 87, 21208 Sremska Kamenica, Serbia, Phone:+381691000808, E-mail: jelica.eremic.djodjic@educons.edu.rs, ORCID ID (https://orcid.org/0000-0002-4890-3351)

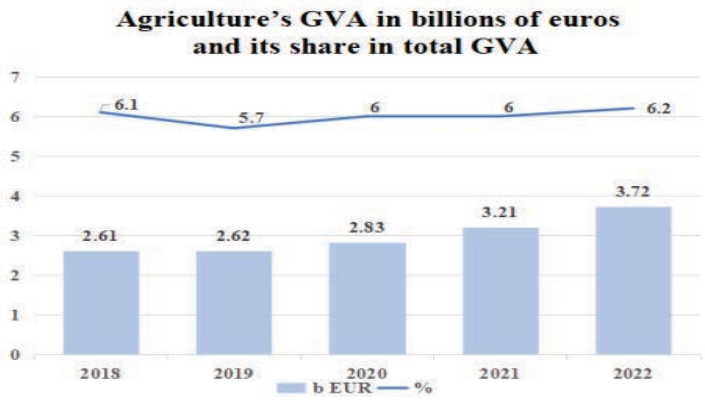
Introduction

Besides contributing to economic development, generating gross domestic product (GDP), and creating jobs, agriculture plays a crucial role in ensuring food security. These aspects have become important considering recent events, such as the COVID-19 pandemic and international conflicts among key agricultural producers in the energy and food markets.

As a major economic activity within the primary sector, agricultural production plays a significant role in the national economy of the Republic of Serbia. Although this sector holds considerable importance for GDP generation, a relative decline has been observed in recent years. Between 1996 and 2005, agriculture's average contribution to GDP was 19.37% (Milić & Pejanović, 2008). More recent studies reveal a significant decline in the share of gross value added (GVA) from agriculture in Serbia's overall GVA between 2002 and 2015. In 2002, the contribution stood at 17%, whereas by 2015, agriculture's share in total GVA had dropped to 8.2%. This decline is primarily because of the significant expansion of other sectors, particularly services, in total economic activity during this period (Novaković, 2019). These figures support the notion that as a country's economy grows, the relative contribution of agriculture to GDP tends to decrease.

According to data from the World Bank (2021), the primary sector in the European Union contributes an average of 1.6% to overall GDP. In Serbia, however, this share is notably higher, averaging around 6% between 2018 and 2022. In absolute terms, GDP generated by agriculture has shown a general upward trend, despite fluctuations caused by global inflation and weather conditions. During the period from 2018 to 2022, agricultural GVA grew by 1.11 billion euros (see Figure 1). While the relative share of the primary sector had fallen below 10% by 2015, economic activities in the secondary and tertiary sectors, which significantly contribute to GDP, have steadily increased. This trend can be considered positive, as the secondary and tertiary sectors generate higher value added compared to the primary sector (Milić et al., 2023).

Figure 1. Agriculture's GVA in billions of euros and its share in total GVA in Serbia from 2018 to 2022



Source: Author's analysis based on data from the Statistical Office of the Republic of Serbia

Analyzing the agricultural population helps to uncover key characteristics and trends within the agricultural sector, allowing for the identification of challenges and opportunities for future development. By examining demographic structure, employment, education, and other relevant factors, we can gain a deeper understanding of the agricultural population dynamics, its influence on rural development, and the factors that shape its productivity and sustainability. These analyses offer valuable insights for policymakers to design strategies that improve the efficiency, competitiveness, and long-term sustainability of agriculture.

Literature review

The demographic analysis of the agricultural sector provides insights into the characteristics of the population engaged in agriculture, including age structure, education, employment, and regional distribution. This data is essential for understanding the dynamics of rural communities and their contribution to agricultural production. Demographic analyses allow the identification of trends, such as the aging of the rural workforce, migration between rural and urban areas, and the need for policies that support the sustainability and development of rural communities.

Nikitović, Magdalenić, and Arsenović (2024) explore demographic processes in the Western Balkans through 2100 about varying socioeconomic conditions. Their study develops three scenarios for future activity patterns based on labor force survey data, considering actual labor participation rates. The results show that depopulation will probably be a prominent characteristic of the region in the coming decades, with international migration playing a more significant role in population trends than fertility. The authors argue that reducing emigration and transitioning to net immigration should be a long-term strategy for a more favorable future.

Popescu et al. (2021) analyzed labor and workforce characteristics in EU agriculture, identifying changes in employment numbers, the number of farmers, the jobs, agricultural land use, standard production, the structure by age, gender, and education level, based on Eurostat data. The general conclusion is that the aging of farmers and labor migration have led to a reduction in the agricultural workforce, but also to the growth of farm size and productivity. The authors also note that the education level of most agricultural workers is relatively low. New technologies, challenges posed by climate change, the need for environmental and biodiversity protection, and the preservation of rural landscapes require farmers to become central actors in rural communities (Popescu et al., 2021).

The analysis of agricultural populations also emerges in the context of crisis periods. Bochtis et al. (2020) aimed to assess the impact of the COVID-19 pandemic on the agricultural workforce and propose strategies for mitigating these effects. The authors concluded that around 50% of agricultural workers were considered being at moderate to high risk of infection, highlighting key vulnerabilities in the sector. Their study, which included many countries worldwide, proposes strategies to protect workers and improve the resilience and sustainability of the agricultural sector.

In terms of research from the region focused on the demographic analysis of agricultural populations, one standout study is by Popescu, Dinu, and Stoian (2018), who analyzed rural populations in Romania from 2007 to 2016. The research shows an overall decline in the rural population of 3.26%, primarily because of low birth rates, high mortality rates, and migration. The rural population is aging, with an imbalanced ratio between individuals over 60 and those aged 0-14. Around 44.73% of the active population lives in rural areas, where 86% are engaged in part-time work. Agriculture employs 40.54% of the rural population, most of whom have limited formal education. Agricultural incomes are 12% lower than the national average. Implementing national rural development programs is expected to improve living standards by advancing education, technology, infrastructure, and social inclusion.

Other authors analyze the agricultural population from the perspective of technological revolutions. Agriculture is undergoing a technological revolution, known as Agriculture 4.0, which relies heavily on information technology. This advancement increases production efficiency, but many farmers in developing countries, including Hungary, struggle to adopt these innovations because of limited access to modern technology and equipment. This creates a long-term problem, termed agricultural deprivation, which is difficult to resolve (Bazsik, Bujdosó, & Koncz, 2022).

Methodology

The methodology for researching the demographic analysis of the agricultural sector in Serbia encompasses a series of steps and techniques used for the collection, analysis, and interpretation of relevant data. The methodology consists of the following elements:

Data Collection: Identifying relevant data sources related to the agricultural population of Serbia. This includes statistical data from national agencies, primarily the Statistical Office of the Republic of Serbia, surveys, and other applicable information sources.

Defining Variables: Defining the key demographic variables to be analyzed. The research examines the most significant statistical indicators related to employment in agriculture in Serbia, with a particular focus on trends over the past period. It investigates the employment rate in Serbia, the share of employed individuals in agriculture within total employment, and the demographic structure of workers in the agricultural sector, including gender, age, education, regional distribution, and type of settlement. Additionally, it compares the rate of informal employment in agriculture to that in other sectors, analyzing trends and providing insights into the current state of the labor market.

Data Analysis: This paper combines descriptive statistics and Probit regression analysis to examine the factors influencing employment trends in Serbia's agricultural sector. The analysis, conducted using STATA statistical software, estimates the probability of agricultural employment based on independent variables such as gender, age group, education level, region, and type of settlement. Since the dependent variable, agricultural employment, takes a binary form (1 if employed, 0 otherwise), the Probit model offers

a more suitable approach than linear regression. Predicted probabilities remain within the [0,1] range while accounting for non-linearity. Moreover, the model proves robust against common issues such as heteroscedasticity and non-normality, which frequently arise in socio-economic data analysis. Estimating marginal effects quantifies how factors like age and education influence the probability of agricultural employment. Combined with descriptive statistics, this approach provides a comprehensive understanding of the demographic and socio-economic drivers of employment, potentially supporting objectives such as rural workforce renewal and the development of sustainable strategies.

Results and discussions

Employment in Serbia (Labor Force Survey - LFS and Central Register of Mandatory Social Insurance - CROSO)

The employment rate in Serbia, measured through the Labor Force Survey (LFS), is a key indicator that reflects the share of employed individuals in the working-age population. This rate provides insights into the current state of the labor market and economic activity in the country. Analysis of the LFS allows for monitoring changes in employment over time, identifying structural changes in the workforce, and assessing the effectiveness of employment policies.

When examining the period between 2019 and 2023, it can be concluded that the employment rate has been gradually increasing. However, due to changes in methodology for processing data in the Labor Force Survey, the data from 2019 and 2020 are not comparable with data from 2021 onward. Therefore, if we consider the period between 2019 and 2020, we conclude that the employment rate increased by 1.01% during this period. Looking at the period between 2021 and 2023, there is a noticeable growth in the employment rate, with minor fluctuations. The employment rate increased by 4.86% when comparing the annual rates from 2021 and 2023. When examining the dynamics on a quarterly basis, it is observed that, except for 2020, the first quarter has the lowest employment rate due to a smaller number of seasonal jobs.

The unemployment rate in Serbia is an important economic indicator that measures the percentage of the active population that is actively seeking work but is currently unemployed. This rate is calculated as the ratio between the number of unemployed individuals and the total active population, which includes people aged 15 and older. A high unemployment rate typically indicates economic challenges and a lack of job opportunities, while a low unemployment rate suggests stability in the labor market. In recent years, the unemployment rate in Serbia has shown fluctuations. As previously mentioned, due to changes in methodology for processing data, the periods from 2019 to 2020 and from 2021 to 2023 should be analyzed separately. Between 2021 and 2023, a trend of decreasing unemployment was observed, which may indicate an improvement in the labor market. Specifically, the annual unemployment rate was lower by 15.32% in 2023 compared to 2021, with the unemployment rate falling from 11.48% to 9.72%, a decrease of 1.76 percentage points.

However, it is important to note that the unemployment rate can be influenced by various factors, including economic changes, employment policies, demographic trends, and other factors that may impact the workforce and economic activity. An example of this can be seen in the second quarter of 2020, when a significantly lower unemployment rate was recorded. The reduction in unemployment during this period can be explained by decreased job-seeking activity during the COVID-19 pandemic, rather than an increase in employment. In the last two quarters of 2020, the unemployment rate stagnated, indicating a reactivation of the unemployed who had been inactive during the lockdown. The number of people who were laid off increased by about 14,000, while the number of those who stopped working due to the end of temporary jobs within the calendar year significantly decreased in the third and particularly in the fourth quarter (Vladisavljević & Lebedinski, 2023).

From 2021 to 2023, there has been a noticeable increase in overall, registered, and formal employment in Serbia. This trend indicates an improvement in the labor market and economic activity in the country. Analysis of employment trends over the past five years provides the following conclusions:

Total Employment: Although an increase has been recorded since 2021, total employment has not yet reached pre-pandemic levels. The number of employed individuals was 2.90 million in 2018, while in 2023, it was 2.84 million. It can be observed that although the number of employed individuals has not increased, the employment rate is rising. Various factors may contribute to this trend. For instance, better regulatory enforcement may compel employers to transition workers previously employed "under the table" to formal employment. Additionally, it is possible that some individuals are being removed from the employed list due to factors such as migration or retirement, but these positions are not being filled with new permanent hires. Generally, due to a declining population, the employment rate is falling.

Registered Employment: The study of registered employment is conducted based on data from the Central Register of Mandatory Social Insurance and the Statistical Business Register. Registered employment includes employees of legal entities, entrepreneurs, self-employed individuals, registered individual farmers, as well as employees in the public sector. It also includes employees based on various modalities of employment (in and out of formal employment), down to the level of municipalities and sectors of activity (Statistical Office of the Republic of Serbia, 2023). The number of registered employees has shown a growth trend from 2019 to 2023. This may indicate an increase in the formalization of employment relationships and a decrease in informal employment. The growth trend is observed in both total registered employment and registered employment excluding individual farmers.

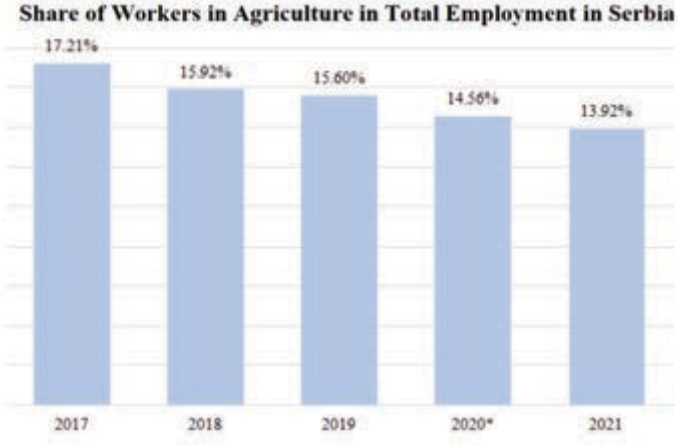
Formal Employment: Formal employment encompasses individuals who have a formal legal employment contract, i.e., an employment relationship established with an employer for a fixed or indefinite period, individuals who independently conduct activities in registered property, or who are founders of registered companies or

entrepreneurial ventures, as well as those engaged in agricultural activities registered with official state institutions (Statistical Office of the Republic of Serbia, 2021). Formal employment also records an increase during the same period from 2021 to 2023. However, as with total employment, the pandemic had a significant impact, with a clear decline observed in 2021 (Statistical Office of the Republic of Serbia, 2023).

Participation of Employed Persons in Agriculture in Total Employment in Serbia

Despite the gradual decrease in the unemployment rate in Serbia, the participation of those employed in agriculture has been steadily declining, and the number of agricultural households is also decreasing. Between 2017 and 2021, the share of workers in agriculture as a percentage of total employment fell by 3.29% (Trading Economics, 2023; Statistical Office of the Republic of Serbia, 2022) (Figure 2).

Figure 2. Share of Workers in Agriculture in Total Employment in Serbia from 2017 to 2021

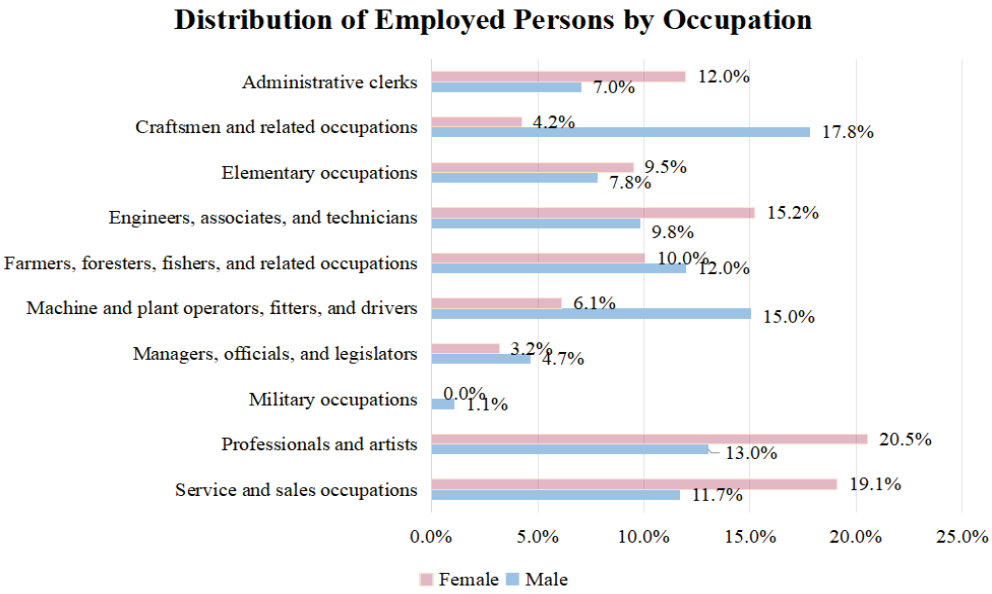


Source: Author's analysis based on data from the Statistical Office of the Republic of Serbia (LFS)

The participation of workers in agriculture in total employment continues to decline, and the number of agricultural households also shows a decreasing trend. From 2018 to 2022, the officially registered average net salaries in the agricultural sector were 14.84% lower than the overall average, with the largest difference observed in 2022, showing a 17.69% difference in net salaries (Statistical Office of the Republic of Serbia, 2022). It is important to note that a significant portion of informal employment includes agricultural activities, meaning that many farmers are employed informally, which poses challenges in monitoring changes in salaries.

When analyzing the structure of employment by occupation, it is concluded that in 2023, farmers accounted for 11% of the total number of employed persons, ranking them fourth among occupations. In terms of gender distribution, there are fewer women employed in agriculture, with a share of 10%, while men account for 12%. Figure 3 shows the percentage of employed persons by occupation and gender (Statistical Office of the Republic of Serbia, 2023).

Figure 3. Distribution of Employed Persons by Occupation and Gender in Percentages in Serbia in 2023



Source: Author's analysis based on data from the Statistical Office of the Republic of Serbia (LFS)

Demographic Structure of Employees in the Agricultural Sector - Gender, Regional, Age, and Educational Distribution

When considering total employment, agriculture accounts for 13.13%, with 373,200 employed workers. It is important to note that this figure includes both formal and informal employees. The gender distribution indicates that a greater number of men are engaged in agriculture, as men constitute 60.08%. This percentage is higher than the proportion of men in total employment, where they make up 54.75% of workers.

The regional distribution of total employment significantly differs from that of employed persons in the agricultural sector. Specifically, the highest number of farmers is found in the Šumadija and Western Serbia region, accounting for 46.80%, which is substantially higher than their participation in total employment, approximately 27%. The lowest participation in agriculture is in the Belgrade region, with a share of 6.06%, which is considerably lower than the share of employed individuals in the Belgrade region in total employment—27%. The Vojvodina region ranks second in terms of the number of employees in the agricultural sector, with a share of 24.81%, slightly less than its participation in total employment, while the South and East Serbia region holds the third position with a share of 22.32%, slightly higher than in total employment. Detailed data can be found in Table 1 (Statistical Office of the Republic of Serbia, 2023).

Table 1. Employed Workers by Sector (Agriculture), Gender, and Region in 2023 (in thousands)

	Republic of Serbia						
	Total	Sex		Serbia - North		Serbia - South	
		Male	Female	Belgrade Region	Vojvodina Region	Šumadija and Western Serbia Region	South and East Serbia Region
Employed Workers (15–89 years)	2842.0	1555.9	1286.1	792.0	743.4	766.1	540.4
Percentage	100%	54.75%	45.25%	27.87%	26.16%	26.96%	19.01%
Agriculture, Forestry, and Fishing	373.2	224.2	149.0	22.6	92.6	174.7	83.3
Percentage	13.13%	60.08%	39.92%	6.06%	24.81%	46.80%	22.32%

Source: Author's analysis based on data from the Statistical Office of the Republic of Serbia (LFS)

Table 2 indicates that the agricultural workforce is aging, as over 50% of employees in the agricultural sector are 55 years or older. The youngest employees, those aged 15 to 34, make up only 13.83% in agriculture, compared to 25.66% when considering all employees. The middle generation constitutes 35.66% of agricultural workers, while in total employment, this percentage is 51.56% (Statistical Office of the Republic of Serbia, 2023).

The age structure of the agricultural workforce in Serbia poses a significant challenge. The high percentage of employees in agriculture who are 55 or older indicates a need for rejuvenating the sector. This could have long-term consequences on productivity and competitiveness in agriculture, as older employees may have less energy and capacity for innovation. Therefore, it is crucial to implement measures to attract younger workers to agriculture and ensure conditions for the sustainable development of this sector.

However, Serbia is not the only country facing this issue. Among the 9.1 million farms in the European Union, the majority (57.6%) of farm managers (both genders combined) were at least 55 years old. Young farmers, defined as those under 40, accounted for only 11.9% of all farm managers. Young farmers are particularly rare in Cyprus (5.1%), Portugal (6.4%), Greece (7.2%), and Spain (7.7%). Their share was higher in Austria (23.4%) and Poland (21.0%). Conversely, a high percentage of farmers aged 65 or older has been noted in many countries; in Portugal, they made up half (50.3%) of all farmers, while high percentages were also recorded in Cyprus (46.4%), Spain (41.3%), and Romania (39.6%). These age structures emphasize the need for policies that encourage farm succession and promote a new generation of farmers (Eurostat, 2022).

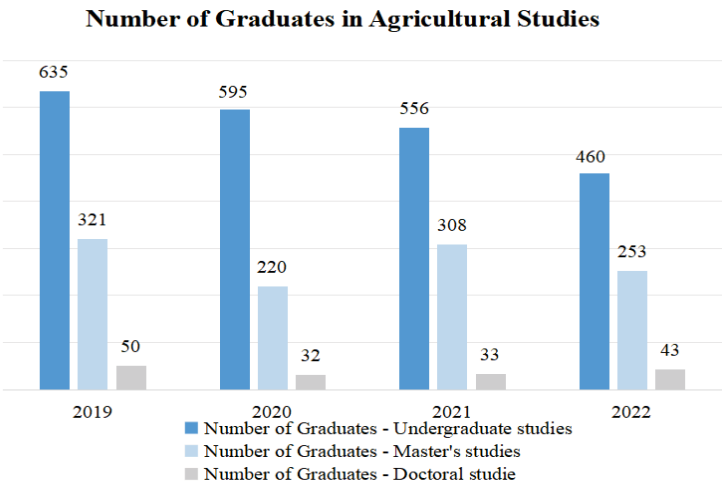
Table 2. Total Employed Workers and Those in the Agricultural Sector by Age Group in 2023 (in thousands)

	15–34	35–54	55 and older
Total	729.2	1465.4	647.4
Percentage	25.66%	51.56%	22.85%
Agriculture, Forestry, and Fishing	51.6	133.1	188.5
Percentage	13.83%	35.66%	50.51%

Source: Author's analysis based on data from the Statistical Office of the Republic of Serbia (LFS)

The current situation in Serbia shows a gradual decline in the number of graduates in agricultural studies, forestry, fishing, and veterinary medicine (Figure 4). Regarding master's degree studies, the situation is somewhat more stable, with fluctuations over the past four years, but without a clear downward trend. As for doctoral studies, the number of PhDs in agriculture has remained relatively stable, at around 40 per calendar year (Statistical Office of the Republic of Serbia, 2022).

Figure 4. Number of Graduates in Agricultural Studies in Serbia from 2019 to 2022



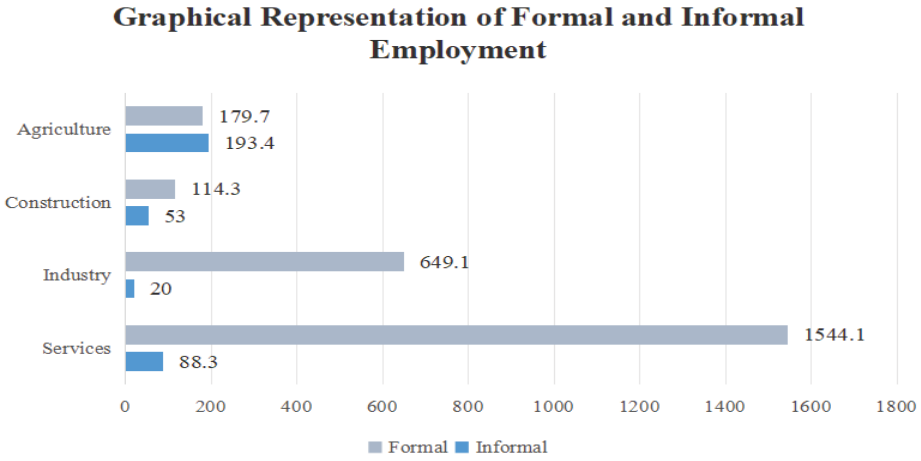
Source: Author's analysis based on data from the Statistical Office of the Republic of Serbia (LFS)

Informal Employment Rates in Agriculture and Outside Agriculture

In 2023, the number of formally employed individuals increased by 34,200, while the number of informally employed individuals decreased by 10,800 compared to 2022. This dynamic resulted in a reduction of the informal employment rate by 0.5 percentage points from the previous year, reaching a level of 12.5%. The agricultural sector experienced a decrease of 5,400 informally employed individuals, the service sector saw a decline of 3,300, and the industrial sector recorded a drop of 1,900. Conversely, the construction sector reported a similar number of informally employed individuals as in the previous year.

In 2023, the total number of informally employed persons across all sectors in Serbia was 354,700, while formal employment reached 2,487,200 workers. In other words, formal employment accounted for 87.52% of total employment, while informal employment comprised 12.48%. According to Figure 5, which displays the number of formally and informally employed individuals in 2023 by four main economic sectors, the agricultural sector stands out as the leader in the number of informally employed persons, both in absolute and relative terms. Specifically, in agriculture, 51.84% of employees are informally employed, indicating that this proportion is about four times higher than in total employment. No other sector exhibits such a drastic share of informal employment as that among agricultural workers (Statistical Office of the Republic of Serbia, 2023).

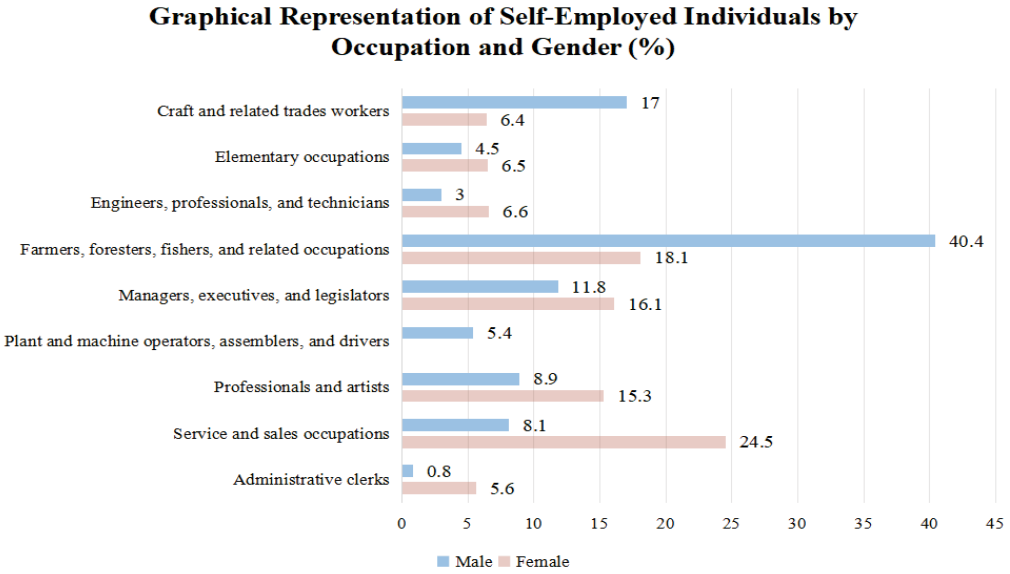
Figure 5. Representation of Formal and Informal Employment by Economic Sector in Serbia in 2023



Source: Author's analysis based on data from the Statistical Office of the Republic of Serbia (LFS)

When considering self-employed individuals by occupation and gender, the agricultural sector again takes the lead, particularly among men. Specifically, 40.4% of self-employed men work in agriculture. The situation is somewhat different among women, where the highest proportion of self-employed individuals comes from the service and trade sectors, accounting for a total of 24.5% of self-employed women. Self-employed women in agriculture represent 18.1% (Figure 6). On the other hand, the smallest number of self-employed individuals is found among administrative staff, both among men and women (notably, there are no self-employed women among machine and plant operators, assemblers, and drivers) (Statistical Office of the Republic of Serbia, 2023).

Figure 6. Representation of Self-Employed Individuals by Occupation and Gender in Percentages in Serbia in 2023



Source: Author's analysis based on data from the Statistical Office of the Republic of Serbia

Application of STATA Software: Regression Analysis of Employment in the Agricultural Sector

Regression analysis of binary (dichotomous) variables is a common task in applied statistics. Models that address binary outcomes focus on the probability p of one outcome occurring, while the alternative outcome has a probability of 1−p. Two standard models for binary outcomes are the logit model and the probit model. These models use different mathematical functions to determine the probability p as a function of the regressors, with estimated coefficient values obtained using the maximum likelihood (ML) method. The linear probability model (LPM), which is fitted using ordinary least squares (OLS), is also frequently used in this type of regression (Cameron & Trivedi, 2009).

The general form of multiple (linear) regression analysis is:

$$Y=\beta_0+\beta_1x_1+\beta_2x_2+...+\beta_kx_k+u \quad (1)$$

Where:

Y - dependent variable (also known as the response variable or target variable);

$x_1, x_2, ..., x_k$ - independent variables (also known as predictor variables or regressors);

β_0 - model constant;

$\beta_1, \beta_2, ..., \beta_k$ - regression coefficients that quantify the impact of each independent variable on the dependent variable;

u - random error or residual, encompassing the effects of all other factors not included in the model.

If the dependent variable is binary, the model is evaluated in the following form:

$$E(y) \equiv p \equiv P(Y=1) = f(\beta_0+\beta_1 x_1+\beta_2 x_2+...+\beta_k x_k+u) \quad (2)$$

Where:

p - the probability that the binary variable takes the value 1;

f - probability distribution function (which can be logit or probit).

Probit regression in this study was conducted to examine the probability of employment in agriculture based on the following independent variables: gender, age group, education, region, and type of settlement. The dependent variable is employment in the agricultural sector. The source of microdata for the regression analysis is the Labor Force Survey, issued by the Statistical Office of the Republic of Serbia.

In the data selection process, a value of 1 is assigned to the agricultural sector, while other sectors are assigned a value of 0. For the independent variables, dummy variables are used for specific categories:

- Gender: male = 0, female = 1;
- Age group: data is extracted for the age group 15-64 years;
- Education: primary education = 1; secondary education = 2; higher education = 3;
- Region: four regions: Belgrade; Southern and Eastern Serbia; Vojvodina; Šumadija and Western Serbia;
- Type of settlement: rural area = 0, urban area = 1.

The results obtained using STATA software are presented in Tables 3 and 4.

Table 3. Output from STATA Software - Probit Regression

	Coefficient	Standard Error	Z-value	P-value
Female	-0.1351093	0.0190059	-7.11	0.000
Age group:				
15-19	0.314135	0.0886649	3.54	0.000
20-24	-0.0265187	0.0572972	-0.46	0.643
25-29	-0.0674448	0.0530054	-1.27	0.203
35-39	0.0299762	0.0471174	0.64	0.525
40-44	0.0950681	0.0444984	2.14	0.033
45-49	0.233147	0.0429839	5.42	0.000
50-54	0.3041624	0.0417999	7.28	0.000
55-59	0.3794928	0.0418243	9.07	0.000
60-64	0.5277929	0.0427915	12.33	0.000
Education:				

	Coefficient	Standard Error	Z-value	P-value
Secondary education	-0.6626029	0.0213947	-30.97	0.000
Higher education	-1.144101	0.0358586	-31.91	0.000
Region:				
Southern and Eastern Serbia	0.5399358	0.0376843	14.33	0.000
Vojvodina	0.7872773	0.0378323	20.81	0.000
Šumadija and Western Serbia	0.9309358	0.0362038	25.71	0.000
Urban	-0.9954068	0.0219479	-45.35	0.000

Source: Author's analysis based on data from the Statistical Office of the Republic of Serbia

The probit regression conducted on a sample of 38,796 observations yielded significant results, with an LR chi2(16) value of 8309.03 and a P-value less than 0.0001, indicating a high level of statistical significance for the model. McFadden's likelihood ratio index, with a value of 0.26, indicates a very good fit for the model.

The results in Table 3 provide a clear picture of the factors affecting the probability of employment in agriculture, highlighting the significance of gender, age, education, and geographical structure of the population, as well as the type of settlement. While the coefficients in the probit regression indicate the impact of independent variables on the latent dependent variable (probit index), the marginal effects demonstrate the influence of independent variables on the probability of the dependent variable. Consequently, the analysis of average marginal effects shows the impact of various factors on the probability of employment in agriculture (see Table 4).

Table 4. Output from STATA Software - Marginal Effects

	Coefficient	Standard Error	Z-value	P-value
Female	-0.0226529	0.003153	-7.18	0.000
Age group:				
15-19	0.0515277	0.015872	3.25	0.001
20-24	-0.003755	0.0080892	-0.46	0.643
25-29	-0.0093714	0.0073407	-1.28	0.202
35-39	0.0043549	0.0068354	0.64	0.524
40-44	0.0142172	0.0065919	2.16	0.031
45-49	0.0369932	0.0066263	5.58	0.000
50-54	0.0496912	0.0065271	7.61	0.000
55-59	0.0638864	0.0066805	9.56	0.000
60-64	0.0939742	0.0072465	12.97	0.000
Education:				
Secondary education	-0.1450956	0.0053315	-27.21	0.000
Higher education	-0.2086821	0.0059104	-35.31	0.000
Region:				
Southern and Eastern Serbia	0.0650952	0.0040456	16.09	0.000
Vojvodina	0.1082607	0.0045646	23.72	0.000

	Coefficient	Standard Error	Z-value	P-value
Šumadija and Western Serbia	0.1373918	0.0043129	31.86	0.000
Urban	-0.1650247	0.0033591	-49.13	0.000

Source: Author's analysis based on data from the Statistical Office of the Republic of Serbia

The results show that women have a 2.27% lower probability of employment in agriculture compared to men, when controlling for the effects of other factors. This difference is statistically significant, with a Z-value of -7.18 and a P-value of 0.000.

Individuals in the age group of 15-19 years have a 5.15% higher probability of employment in agriculture compared to the reference group (30-34 years). For age groups 20-24, 25-29, and 35-39 years, the differences are not statistically significant. Individuals aged 40-44 have a 1.42% higher probability of employment in agriculture compared to the reference group. The age group of 45-49 years has a 3.70% higher probability of employment in agriculture compared to the reference group. Individuals aged 50-54 have a 4.97% higher probability, while the age group of 55-59 has a 6.39% higher probability of employment in agriculture compared to the reference group. Finally, individuals aged 60-64 have a 9.40% higher probability of employment in agriculture compared to the reference group, when controlling for other factors.

Individuals with secondary education have a 14.51% lower probability of employment in agriculture compared to those with primary education. Those with higher education have an even lower probability of employment in agriculture, at 20.87% compared to those with primary education, when controlling for the effects of other factors.

Regional analysis indicates that individuals living in the Southern and Eastern Serbia region have a 6.51% higher probability of employment in agriculture compared to those in Belgrade. Similarly, residents of Vojvodina have a 10.83% higher probability of employment in agriculture compared to Belgrade, while individuals from the Šumadija and Western Serbia region have a 13.74% higher probability of employment in agriculture when controlling for the effects of other factors.

The results show that individuals living in urban areas have a 16.50% lower probability of employment in agriculture compared to those in rural areas, which is highly statistically significant with a P-value of 0.000.

These results clearly indicate significant differences in the probability of employment in agriculture based on gender, age group, education, geographical region, and type of settlement, providing deeper insight into the employment structure in this sector.

Regarding the quality of the conducted model, it correctly classified 86.94% of all observations, indicating relatively high overall accuracy in predicting employment in agriculture. The model exhibits high specificity and overall accuracy, meaning it is very effective at identifying those not employed in agriculture. However, its sensitivity is relatively low, suggesting that the model has difficulties accurately identifying all

individuals employed in agriculture. The high negative predictive value indicates that the model reliably identifies those not employed in agriculture, but is less reliable in identifying those who are employed (Figure 7).

Figure 7. Model Quality Assessment

Probit model for agri_sektor

Classified	True D	True ~D	Total
+	1374	875	2249
-	4193	32354	36547
Total	5567	33229	38796

Classified + if predicted Pr(D) >= .5
True D defined as agri_sektor != 0

Sensitivity	Pr(+| D)	24.68%
Specificity	Pr(-|~D)	97.37%
Positive predictive value	Pr(D| +)	61.09%
Negative predictive value	Pr(~D| -)	88.53%
False + rate for true ~D	Pr(+|~D)	2.63%
False - rate for true D	Pr(-| D)	75.32%
False + rate for classified +	Pr(~D| +)	38.91%
False - rate for classified -	Pr(D| -)	11.47%
Correctly classified		86.94%

Source: Author's analysis based on data from the Statistical Office of the Republic of Serbia

Conclusion

The analysis of employment data in Serbia reveals several key trends and challenges. The employment rate is increasing, while the unemployment rate is declining, suggesting positive changes in the labor market. However, changes in the methodology for data processing complicate direct comparisons of data before and after 2021. The agricultural sector continues to see a steady decline in its share of total employment, accompanied by an increase in informal employment. Agriculture has the highest proportion of informally employed individuals, which presents challenges for monitoring wages and working conditions.

The demographic structure of agricultural workers shows a high percentage of older individuals, while the participation of younger workers is very low. This age structure indicates a need for rejuvenation in the sector to ensure long-term sustainability and competitiveness. The regional distribution of employed individuals reveals that the highest number of farmers is in Šumadija and Western Serbia, while Belgrade has the fewest employed in agriculture. Agriculture is the most common occupation among the self-employed, particularly among men. To enhance the sector, it is essential to

encourage young farmers, formalize employment in agriculture, and adapt policies to increase productivity and competitiveness.

The results of the regression analysis show significant differences in the probability of employment in agriculture based on the examined factors. Women have a lower probability of employment in agriculture compared to men. The age group of 15-19 years has a higher probability of employment in agriculture compared to the reference group (30-34 years), while older age groups, particularly those aged 50-54 and 55-59 years, have a significantly higher probability of employment in agriculture. Education plays an important role in the probability of employment in agriculture: individuals with secondary and higher education have significantly lower probabilities of employment in this sector compared to those with primary education. Geographic regions also show significant differences. Individuals living in Southern and Eastern Serbia, Vojvodina, and Šumadija and Western Serbia have a higher probability of employment in agriculture compared to residents of Belgrade. Furthermore, individuals living in urban areas have a significantly lower probability of employment in agriculture compared to those from rural areas.

The model used in the analysis demonstrates high overall accuracy in predicting employment in agriculture, with particularly high specificity. The results provide deeper insights into the structure of employment in agriculture, highlighting the importance of various demographic, educational, and geographic factors. They can contribute to a better understanding of the dynamics of employment in agriculture and assist in developing effective policies to support and grow this sector. Given the lower probability of employment for women in agriculture, specific training and support programs can be developed to increase their participation in this sector. Since older age groups show a higher probability of employment in agriculture, programs aimed at young farmers can help encourage greater involvement of the younger population in rural areas. Based on the obtained results, efforts can be made to promote agriculture as an attractive career through educational programs and to provide additional opportunities for education in agronomy and related fields. On the other hand, increased support for regions with a higher probability of employment in agriculture, such as Southern and Eastern Serbia, Vojvodina, and Šumadija and Western Serbia, can help maintain and improve agricultural production. Given the higher probability of employment in agriculture for individuals living in rural areas, rural development strategies can include improving infrastructure, working conditions, and access to markets for farmers.

Serbia has the potential for further development of the agricultural sector due to its fertile land and tradition in agricultural production. However, to capitalize on these opportunities, the state faces certain challenges, including the need to modernize agricultural practices, improve supply chains, and adapt to global trends in consumer preferences. Integrating innovations, technological advancements, and government support for the sector are key elements that can enhance this sector. Addressing the issue of an aging agricultural workforce in conjunction with education may be crucial for long-term solutions. Providing education on modern agricultural techniques,

technologies, and innovations can help increase productivity and efficiency in the sector. The younger generation can be trained to utilize new technologies, which may attract more young people to engage in agriculture. Additionally, agricultural education in schools can also assist in this situation. Introducing agricultural education into the school system can spark young people's interest in agriculture and provide them with foundational knowledge of this sector from an early age. This could include practical activities such as gardening or managing small farms within educational programs.

Scholarship and support programs also play a key role. Developing scholarship and financial support programs for young people who wish to pursue education in agriculture can motivate them to choose a career in this sector. These programs may include subsidies for agricultural education, scholarships for agricultural colleges, or support for internships on farms. Supporting research and innovations, as well as investing in research and development in agriculture, can create new opportunities for improving the sector and attract young people interested in innovations and technological progress.

Agriculture in Serbia continues to play an important role in traditional lifestyles, especially in rural areas. Many families rely on agriculture as their main source of income, and knowledge and labor in the field are often passed down from generation to generation. Additionally, agriculture is a seasonal activity. During certain times of the year, such as spring and autumn, more labor is needed for land preparation, planting, or harvesting. As a result, many people who cannot find year-round employment seek seasonal jobs in agriculture.

Insufficient investment in agriculture, particularly in rural areas, leads to many farms remaining small or medium-sized. This often results in a lack of formal job opportunities in agriculture, forcing people to turn to informal employment on family farms or as seasonal workers. Moreover, the complexity of administrative procedures, high taxes, and costs for employers can make formal employment in agriculture challenging. This can encourage people to prefer informal jobs to avoid such challenges.

Conflict of interests

The authors declare no conflict of interest.

References

1. Bazsik, I., Bujdoso, Z., & Koncz, G. (2022). The Situation of Hungarian Farmers in the Era of Agriculture 3.0 and 4.0. *Acta Carolus Robertus, 12*(2). https://doi.org/10.33032/acr.2907
2. Bochtis, D., Benos, L., Lampridi, M., Marinoudi, V., Pearson, S., Sørensen, C. (2020). Agricultural Workforce Crisis in Light of the COVID-19 Pandemic. *Sustainability 2020, 12*(19), 8212. https://doi.org/10.3390/su12198212

3. Cameron, A., C., & Trivedi, P., K. (2009). *Microeconometrics Using Stata.* A Stata Press Publication, Texas. Retrieved from: https://drive.google.com/file/d/1yKUkSqKOehw4Fa1SAkdkeUEea1v5pU1B/view?ts=66017f2a (July 22, 2024)
4. Đukić, S., Tomaš Simin, M., & Glavaš-Trbić, D. (2017). The Competitiveness of Serbian Agro-Food Sector. *Economics of Agriculture*, *64*(2), 723-737 .https://doi.org/10.5937/ekoPolj1702723D
5. Eurostat (2022). *Farmers and the Agricultural Labour Force - Statistics.* Retrieved from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Farmers_and_the_agricultural_labour_force_-_statistics (June 10, 2024)
6. Milić, D., & Pejanović, R. (2008). Investments in Serbian Agriculture. *Economics of Agriculture*, *55*(1), 9-19. https://doi.org/10.59267/ekoPolj2302411M
7. Milić, D., Jocić, B., Novaković, T., Tekić, D., Ilić, Z., & Maksimović, B. (2023). Investments In Serbian Agriculture. *Economics of Agriculture, 70*(2), 411-422. https://doi.org/10.59267/ekoPolj2302411M
8. Nikitović, V., Magdalenić, I., & Arsenović, D. (2024). The Demographic Future of Western Balkans: Between Depopulation and Immigration. *European Studies of Population, ESPO, 26,* 19-43. https://doi.org/10.1007/978-3-031-53088-3_2
9. Novaković, T. (2019). The Analysis of Gross Value Added of Agricultural Production in the Republic of Serbia. *Economic Ideas and Practice*, *32,* 39-55.
10. Popescu, A., Dinu, T., A., & Stoian, E. (2018). Demographic and Economic Changes Characterizing the Rural Population in Romania. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 18*(2), 333-346. Retrieved from: https://managementjournal.usamv.ro/pdf/vol.18_2/Art44.pdf (May 10, 2024)
11. Popescu, A., Tindeche, C., Marcuță, A., Marcuță, L., Honțuș, A., & Angelescu, C. (2021). Labor Force in the European Union Agriculture - Traits and Tendencies. *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, 21*(2), 475-486. Retrieved from: https://managementjournal.usamv.ro/pdf/vol.21_2/Art55.pdf (May 11, 2024)
12. Statistical Office of the Republic of Serbia (2023). *Labor Force Survey in the Republic of Serbia.* Retrieved from: https://publikacije.stat.gov.rs/G2024/Pdf/G20245707.pdf (May 08, 2024)
13. Statistical Office of the Republic of Serbia (2023). *Registered Employment.* Retrieved from: https://www.stat.gov.rs/sr-latn/oblasti/trziste-rada/registrovana-zaposlenost/ (May 08, 2024)
14. Statistical Office of the Republic of Serbia (2021). *Labor Force Survey, from 2021. Metadates.* Retrieved from: https://data.stat.gov.rs/Metadata/24_Zarade/Html/240003_ESMS_G0_2021_2.html (May 12, 2024)

15. Statistical Office of the Republic of Serbia (2022). *Labor Force Survey, Employed Persons by Occupation, Sex, and Region.* Retrieved from: https://data.stat.gov.rs/Home/Result/240003020206?languageCode=en-US (May 22, 2024)
16. Statistical Office of the Republic of Serbia (2022). *Number of Graduated Students by Fields of Education - 1st Degree Studies.* Retrieved from: https://data.stat.gov.rs/Home/Result/1104020102?languageCode=en-US (May 16, 2024)
17. Statistical Office of the Republic of Serbia (2022). *Number of Graduated Students by Fields of Education - 2nd Degree Studies.* Retrieved from: https://data.stat.gov.rs/Home/Result/1104020202?languageCode=en-US (May 09, 2024)
18. Statistical Office of the Republic of Serbia (2022). *Number of Graduated Students by Fields of Education - 3rd Degree Studies.* Retrieved from: https://data.stat.gov.rs/Home/Result/1104020302?languageCode=en-US (May 08, 2024)
19. Statistical Office of the Republic of Serbia (2022). *Average Monthly Earnings for the Year by Divisions of Activity.* Retrieved from: https://data.stat.gov.rs/Home/Result/2403040402?languageCode=en-US (May 15, 2024)
20. Statistical Office of the Republic of Serbia (2023). *Labor Force Survey: Rates of Activity, Employment, Out of Labour Force and Unemployment (from 2011).* Retrieved from: https://data.stat.gov.rs/Home/Result/240003020102?languageCode=en-US (May 08, 2024)
21. Statistical Office of the Republic of Serbia (2023). *Labor Force Survey: Formally/Informally Employed Persons.* Retrieved from: https://data.stat.gov.rs/Home/Result/240003020201?languageCode=en-US (May 18, 2024)
22. Statistical Office of the Republic of Serbia (2023). *Gross Value Added by Activities.* Retrieved from: https://data.stat.gov.rs/Home/Result/0902010301?languageCode=en-US (May 27, 2024)
23. Statistical Office of the Republic of Serbia (2023). *Registered Employment (from 2015).* Retrieved from: https://data.stat.gov.rs/Home/Result/24021101?languageCode=en-US (May 18, 2024)
24. Trading Economics (2023). *Database*. Retrieved from: https://tradingeconomics.com/ (June 02, 2024)
25. Vladisavljević, M., & Lebedinski, L. (2023). *Social Stability in Serbia Challenged? Effects of the First Year of COVID-19 Pandemic on the Labour Market and the Position of Vulnerable Groups in Serbia.* Institute of Economic Sciences, Belgrade, Serbia. Retrieved from: https://www.library.ien.bg.ac.rs/index.php/monog/article/view/1586/1299 (May 04, 2024)

DIGITAL MAPPING OF BUSINESS PERFORMANCE INDICATORS OF AGRICULTURAL HOLDINGS IN SERBIA

Žarko Rađenović[1], Ivana Janjić[2], Miljana Talić[3], Milica Đokić [4], Tamara Rađenović [5], Tatjana Boshkov [6], Bojan Krstić [7]

**Corresponding author E-mail: tatjana.boskov@ugd.edu.mk*

ARTICLE INFO

Original Article

Received: *06 December 2024*

Accepted: *15 January 2025*

doi:10.59267/ekoPolj2501225R

UDC 004:[338.31:631.115(497.11)

Keywords:

Digital Agriculture, ICTs, Business Performance, Digital Maps

***JEL**: Q10, Q19*

ABSTRACT

The capacity of new technologies to boost agricultural yields, optimize resource utilization, enhance productivity, and improve financial outcomes has gained significant consideration among farmers, agricultural organizations, and policymakers. Across the globe, innovative digital solutions have emerged as key catalysts for transforming and advancing the agricultural sector. Hence, this study explores the adoption of digital tools by Serbian agricultural holdings to enhance business performance and sustainability. The employed mixed-methods approach highlights disparities in digital readiness and the barriers faced by small-scale farmers. Results reveal that while smartphones dominate technology use, broader adoption of digital platforms is hindered by low digital literacy, high costs, and limited infrastructure. The findings emphasize the potential of digital agro-economic maps to optimize resource allocation, reduce costs, and improve decision-making. Finally, the actions should be focused on improving digital literacy of rural population, expanding technological infrastructure, and designing policy incentives to encourage the adoption of smart agricultural practices.

1 Žarko Rađenović, Ph.D., Research Associate, Innovation Centre, University of Niš, University Square 2, 18000 Niš, Serbia, Phone: +381638787359, E-mail: z_radjenovic89@outlook.com, ORCID ID (https://orcid.org/0000-0002-3679-7870).

2 Ivana Janjić, Ph.D., Research Associate, Innovation Centre, University of Niš, University Square 2, 18000 Niš, Serbia, Phone: +381637003801, E-mail: ivana.janjic@junis.ni.ac.rs, ORCID ID (https://orcid.org/0000-0003-3142-8467).

3 Miljana Talić, Ph.D. candidate, Research Assistant, Innovation Centre, University of Niš, University Square 2, 18000 Niš, Serbia, Phone: +381640374243, E-mail: tmiljana@hotmail.com, ORCID ID (https://orcid.org/0000-0003-1017-8788).

4 Milica Đokić, Ph.D. candidate, Research Assistant, Innovation Centre, University of Niš, University Square 2, 18000 Niš, Serbia, Phone: +381638854675, E-mail: milica91nis@hotmail.com, ORCID ID (https://orcid.org/0000-0002-7155-3476).

5 Tamara Rađenović, Ph.D., Assistant Professor, Faculty of Occupational Safety, University of Niš, Čarnojevića 10a, 18000 Niš, Serbia, Phone: +38163424365, E-mail: tamara.radjenovic@znrfak.ni.ac.rs, ORCID ID (https://orcid.org/0000-0003-1632-7772).

6 Tatjana Boshkov, Ph.D., Full professor, Faculty of Tourism and Business Logistics University Goce Delchev, Stip "Krste Misirkov" no. 10-A P.O. Box 201 Stip 2000, North Macedonia, Phone: +38971335097, E-mail: tatjana.boskov@ugd.edu.mk, ORCID ID (https://orcid.org/0000-0001-8821-9223).

7 Bojan Krstić, Ph.D., Full professor, Faculty of Economics, University of Niš, Trg kralja Aleksandra Ujedinitelja 11, 18000 Niš, Serbia, Phone: +381 18 528 685, E-mail: bojan.krstic@eknfak.ni.ac.rs, ORCID ID (https://orcid.org/0000-0003-4597-6819)

Introduction

During its long history, the modernization of agriculture has progressed gradually, mostly in correlation with the stages of intensive development of science and technology. "Smart farming", also known as Agriculture 4.0 marks a new era in agriculture, driven by the comprehensive integration of digital technologies (Geng et al., 2024). Although digital technologies for improving agriculture were recognized more than 50 years ago, digital agriculture emerged in the early 2000s. In the past few decades, digital agriculture has become a key driver of industrial integration and innovation. Digital agriculture represents a modern approach to agriculture that combines and integrates the principles of efficiency, high quality, environmental responsibility and sustainable development (Zhou et al., 2023).

Over the past two decades, the importance of information and communication technologies (ICTs) in the agricultural industry has grown rapidly, contributing to innovation and efficiency in the sector (Leng et al., 2022). ICTs in agriculture include digital platforms, sensors, IoT (Internet of Things), robotics and drones, big data, cloud computing, artificial intelligence (AI), blockchain, sixth-generation (6G) communication technology, machine learning, digital twin, etc. (Flamini & Naldi, 2022). As the agricultural industry faces the challenges of resource constraints, increasing demand and sustainability concerns, the use of new digital technologies is becoming crucial (Confo et al., 2023). New digital technologies and solutions may give a new impetus to the renewal of the agricultural ecosystem, improving the efficiency of resource distribution, reducing resource disparities and propelling advancements in agricultural practices quality (Bocean, 2024). A broad spectrum of technologies enables agricultural holdings to efficiently plan, monitor and manage both the operational and strategic aspects of their production systems, optimizing agricultural productivity and reducing ecological footprints (Karunathilake et al., 2023).

Identifying effective agricultural practices and solutions based on new digital technologies is essential for enhancing agricultural profitability and maintaining economic stability (Boecan, 2024). Digital agricultural practices can improve agricultural efficiency and sustainability while lowering resource waste and environmental impact. Increases in the efficiency of agribusiness are a connection between the improvement in productivity and the reduction of inputs through the use of technologies (Pérez-Pons et al., p. 48, 2020).

Furthermore, the advancements of agricultural digital tools have an important role in addressing food scarcity challenges and meeting the growing global demand for sustainable food production, offering strategic solutions for improving the efficiency and effectiveness of farm production. Efficient farm management relies on effectively utilizing production resources and maximizing profits based on limited financial and credit resources. Certain researchers (Bahn et al. 2021) have examined the role of digital technologies in improving business performance. They have discovered that the use of digital technologies can decrease production costs by monitoring agricultural inputs and labour.

Digital technologies have driven revolutionary changes in agriculture by enabling the development of smart systems that can monitor, control, and visualize different farm operations in real-time (Subeesh & Mehta, 2021). Real-time data and analysis in smart agriculture are prerequisites for sustainable development. Real-time analysis can help agricultural holdings better understand plant growth status, weather, and soil conditions. A key role in the automation of farming activities during pre-harvest and post-harvest operations is played by AI and IoT, developing smart farm machinery, greenhouse management, storage systems, etc. (Subeesh & Mehta, 2021).

Digital technology can reduce the cost of obtaining information and transaction costs for agricultural export enterprises, and improve their brand influence and competitiveness in the international market (Jia, 2024). Agricultural supply chain management could be optimized by using digital technologies. Some academics (Site & Salucci, 2006) concluded that the application of digital tools enables rural agricultural holdings to access both domestic and global markets. The new digital era and modern conditions highlight the significance of precision agriculture, based upon digital technologies for weather forecasting and the predictability of weather conditions. The information delivered by digital tools for weather prediction can be used by agricultural holdings to decide about planting and harvesting time (Fuentes-Peñailillo et al., 2024).

The potential of new technologies to increase yields, efficiency of resource use, productivity and financial gains in agriculture has been recognized by many farmers, agriculture organizations and policy-makers. Innovative digital solutions have been major drivers of agricultural transformation and enhancements across the world. Many countries and integrations, especially advanced economies, have been developing strategies for higher digitalization of the agricultural sector. The adoption of innovative tools in agricultural business that provide real-time data and relevant economic indicators significantly facilitates the decision-making process and contributes to the production process optimization, profitability growth and sustainability as well.

Digital agriculture is stated as one of the Program Priority Areas (PPAs) in the FAO Strategic Framework 2022-31 by the Food and Agricultural Organization of the United Nations (FAO), which could contribute to creating resilient and sustainable agri-food systems (FAO, 2021). Furthermore, the importance of technology, innovation and data in agriculture has been emphasized, identifying them as major accelerators of progress towards meeting the Sustainable Development Goals (SDGs) and FAO's vision, applied in all programmatic interventions.

Although the adoption and usage of digital technologies in agriculture have been widespread and accelerated in recent years, discrepancies among different areas and subjects remain significant. Disparities are particularly high between developed and developing countries and between international companies and local firms, especially family farms, mainly due to different levels of education, financial resources, access to infrastructure and technology, as well as the scale at which they operate (Trendov, Varas & Zeng, 2019). Besides that, the climate, demographic and ecosystem characteristics

of different areas vary considerably. Therefore, the need for a differentiated strategic approach at the regional and national levels is essential. Policymakers must identify appropriate instruments to target existing problems and constraints.

Despite differences among countries, some common factors of adoption and efficient utilization of digital technologies in agriculture have been identified. The practice of OECD countries indicates that policymakers should address issues related to infrastructure and connectivity, cost, relevance, user-friendliness and skills, and risk and trust-building to implement and facilitate the digitalisation of agriculture (McFadden et al., 2022). The lack of trust in new and often complex technologies has been identified as one of the major obstacles to greater adoption and usage of digital tools among farmers, including four issues: privacy, security and sharing of data; mistrust of technology providers, difficulty in learning and misunderstanding of new technologies; and lack of standards for assessment and certification of the functionality of digital tools (McFadden, Casalini & Antón, 2022).

Therefore, it is crucial that policies and programmes for agricultural digitalization provide an environment which would boost farmers' trust and encourage them to use digital technologies, giving them all the necessary knowledge and protection. The role of national governments in defining and carrying out an agricultural policy which would include innovative and technology-driven solutions is fundamental. Evidence suggests that digital technology increases the precision of policy instruments and enables their tailoring to specific agricultural problems, increasing the efficiency and effectiveness of agricultural policy (Ehlers, Huber & Finger, 2021).

Many estimates suggest that digital technologies will significantly change the agriculture and food sector over the next decade, but a significant gap between emerging and advanced economies still limits the achievement of the full potential of the agricultural revolution (Trendov, Varas & Zeng, 2019). The experience of the EU and other countries showed that successfully accomplishing the digital transition of agriculture and rural areas demands solutions which are able to respond to their specific requirements, needs, resources and issues, making it a "complex and context-specific process" (Barabanova & Krzysztofowicz, 2023, p.43). European Union has put a lot of effort into supporting the digitalisation of rural areas and integration of new technologies in the European agricultural value chains. Digital technologies are perceived not only as a tool for more efficient and sustainable production in the agricultural sector but also as one of the major "elements to improve quality of life, ensure geographically balanced development and economic prosperity" of rural areas (Barabanova & Krzysztofowicz, 2023, p.3).

Innovation and research activities for accelerating the digital transformation of the agricultural sector have been encouraged across the continent through many policy instruments, as well as the monitoring of its economic and social impact on rural areas. They are designed to support farmers, rural communities and related sectors through the use of digital technologies, innovation and data-driven practices. Certain regions, like Eastern Europe, still lag behind highly developed EU countries. Application of

information technologies in agriculture remains low due to mainly small family farms or agricultural businesses and the unfavourable educational and age structure of the rural population, which often does not have enough financial funds to invest in modern equipment and sustainable practices (Jurjević et al., 2019).

Serbia is a country where the agricultural sector is an important segment of the economy, with a share between 6.3% and 7.7% in GDP in the last five years, in overall employment around 13-16% and in exports up to 21.3% (SPP, 2024). However, the reduction of the rural population and in employment in agriculture has been evident. That trend is particularly present among the population with higher education. Such circumstances usually lead to the lower quality of the workforce in agriculture which is one of the factors that hinders the economic development of rural areas. According to the data from the current Strategy for Agriculture and Rural Development of the Republic of Serbia (2014-2024), 97% of the rural population did not attend additional training programs, and 54% did not have special knowledge and skills, while only 20% was computer literate, 14% was partially computer literate and approximately 66% was still computer illiterate (Official Gazette RS, 2014).

The diffusion of broadband internet connection was also significantly lower in rural areas. Although the internet infrastructure has been improved in recent years, as well as the availability of knowledge and technology, the digital gap between rural and urban areas is still noticeable. High costs of digital tools and technology devices, lack of knowledge about the benefits of their application and sceptical attitude towards innovations often cause farmers to opt for traditional means and avoid digital solutions (Jurjević et al., 2019; FAO, 2020; Kovljenić et al., 2023). In order to experience the most benefits from the digitalisation of agriculture and rural areas, developing countries would have to prioritize the improvement of technological infrastructure and digital literacy and skills of rural communities, as well as access to services and financial funds.

This article aims to point out the main benefits of agriculture digitalization, to emphasize its importance for sustainable development of rural areas and to address some of the main issues. It also highlights the major barriers to agricultural digitalization in Serbia, as well as prioritized areas for improving the competitiveness of the agricultural sector. The object of the research presented in this paper is to analyse the readiness of farmers and agricultural holdings for the adoption and use of digital tools and technological solutions in their business and to assess the current level of implementation. Furthermore, it gives insights into farmers' attitudes towards the application of information technologies and analytical tools which would help their agricultural holdings improve their business performance.

Materials and methods

In order to examine the use of digital technologies by agricultural holdings in Serbia and to explore the potential for the implementation of certain digital solutions at the individual holdings level, a survey was conducted. The research was a phase in the process of creating and validating an innovative solution, a digital agro-economic map, which

aims to help agricultural holdings improve their business performance. The structure and content of the research were created based on observed problems faced by agricultural holdings, especially in less developed regions of Serbia. Although Serbia is characterized by a favourable climate, vast expanses of arable land and a tradition of growing numerous crops, there is plenty of room for improving the competitiveness of domestic agricultural holdings. Problems are present at multiple levels, from the low level of mechanization and modernization, outdated machinery, and insufficient application of new technological solutions, to individual characteristics of farmers such as inadequate and outdated knowledge and skills (Statistical Office of the Republic of Serbia, 2019). These are just some of the obstacles that the agricultural sector in Serbia faces.

There are 508,365 registered agricultural holdings in Serbia (Statistical Office of the Republic of Serbia, 2024), and most of them, especially those operating in underdeveloped areas, are characterized by a low level of digital literacy. According to available data on the IT literacy of farmers, less than 2% of agricultural holdings use a computer, and low IT literacy is also a consequence of the very unfavourable age structure of farmers (Statistical Office of the Republic of Serbia, 2019). Also, according to recent research, significant digital support is needed for farmers to use modern agro-platforms and electronic registers (Research report *"The level of digital literacy and analysis of the required form of support with recommendations for improving the level of digital support for farmers"*). This is supported by the fact that the participation of farmers aged over 65 in the age structure of agricultural holdings represents a significant percentage (44.72%) (Statistical Office of the Republic of Serbia, 2024). At the same time, the use of business analytics in such areas can be an obstacle, but with adequate education and consulting assistance, the business performance of holdings can be improved and their profitability can be increased. It has been recognized that there is a need for farmers for incentive mechanisms to encourage them to actively participate in the process of digitalization of agriculture, and thus also increase the creation of added value and reduce business costs.

Available research also provides data that the largest number of decision-makers of agricultural holdings in Serbia (49%) gained their knowledge about agricultural business through practice, and therefore base their decision-making on previously acquired experience, which is not the path to creating an economically strong and sustainable farm (Statistical Office of the Republic of Serbia, 2019). Empirical determination of prices and operating costs by holdings without modern, software-based business analytics and long-term predictions does not lead to maximum product placement on the market and increased profitability, and reduces the ability of farmers to approach modern business flows and the digitalization of the agricultural sector.

In order to develop the proposed tool, a digital agro-economic map, it was necessary to research the market's readiness to accept and implement such a solution, since the application of digital agro-economic maps in agriculture is linked to farmers' awareness of the importance of business analytics and their willingness to accept new approaches to business. For this purpose, qualitative research was conducted. A semi-structured

questionnaire was created, including a set of questions needed to assess the digital literacy and readiness of farmers for digitization. GoogleForms was used to create the questionnaire, and it was sent by e-mail to farmers from the previously created contact database. The contact database was created based on the available databases of agricultural holdings in Serbia such as E-Agrar and Agricultural Advisory Agency of the Republic of Serbia. An example of the digital map for the agriculture holding producing blueberries is presented in Figure 1.

Figure 1. Digital agro-economic map

Source: Authors

The questions were formulated based on an earlier review of the existing literature and observed gaps in the operations of agricultural holdings. The questionnaire consists of several sets of questions. The first set of questions refers to the demographic characteristics of representatives of agricultural holdings and the area of operation of the agricultural holdings. The second set of questions was created to assess their knowledge and skills in the field of digitalization of agriculture, while the focus of the third set of questions is on the application of technology and digital tools for agricultural management, as shown in Table 1.

Table 1. Digital agricultural tools examination for analysed issues

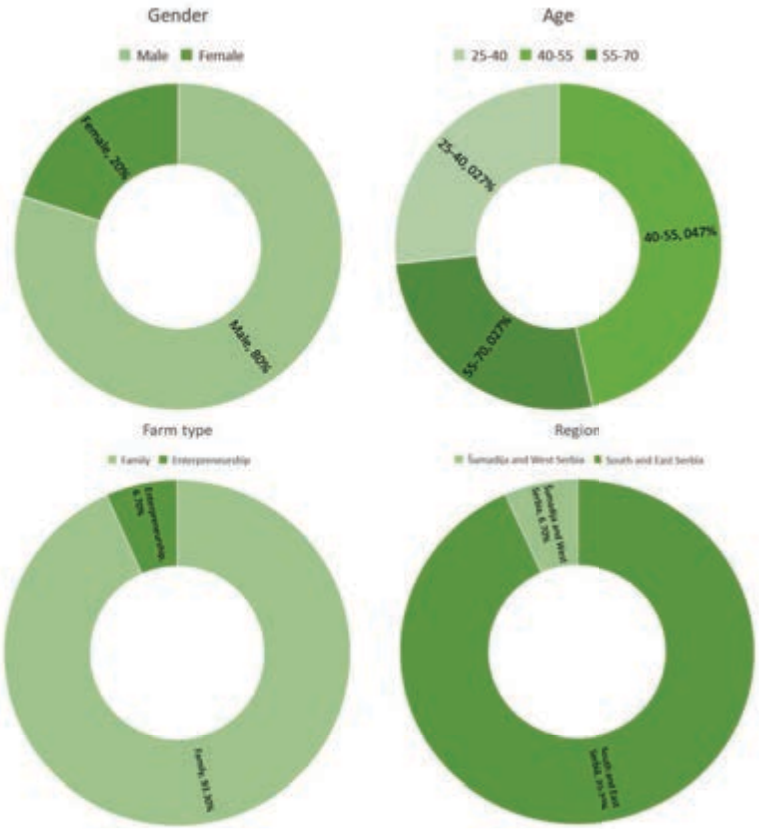
Analysed agricultural digital issues	**Utilized digital agricultural assets**		
Type of technology for managing agricultural holdings	"Smart" phone	PC	Drone, GPS
Agricultural applications for managing agricultural holdings	E-mail Social media Cloud systems	Internet browsing options	Local government agricultural apps
Type of agricultural digital service for managing agricultural holdings	Digital agricultural platforms	Information-oriented apps for rural areas	Municipality agro-platforms
Type of agricultural activities which utilized agricultural digital toolbox	Weather forecast Market condition Efficient resource allocation	Process automatization Subsidies Supply chain management	Revenues/Expenses Import/Export Education of farmers through digital platforms

Source: Authors

The research sample consisted of 45 representatives of agricultural holdings. The target group consisted of agricultural holdings from the regions of Southern and Eastern Serbia and most of the participants in the research were from Nišava, Toplica, Jablanica, Pčinj, Pirot, Rasina and Zaječar areas. According to the Statistical Office of the Republic of Serbia (2024), the region of Southern and Eastern Serbia has a total of 145,744 agricultural holdings, of which there are 124,971 agricultural holdings in prominent areas.

As for the demographic characteristics of the representatives of the surveyed agricultural holdings (age, gender), the percentage of men is significantly higher, as much as 80%, as shown in Figure 2. The largest number of respondents were aged 40-55 (47%), while the number of respondents aged 25-40 and 55-70 was the same (27%). This age structure of the sample may be a consequence of the greater use of computers and the Internet by younger farmers, as the questionnaire was in an online form, sent by email.

Figure 2. Characteristics of the sample



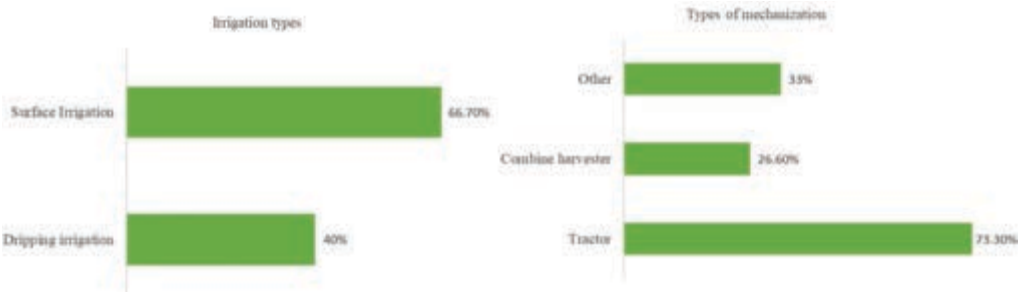
Source: Authors

When it comes to the type of agricultural holdings, the percentage of those registered as family agricultural holdings (93%) is significantly higher than those registered as enterprises (7%), which is also shown in Figure 2. The sample consisted of agricultural holdings of different structures that deal with agricultural and livestock production, fruit and vegetable processing, meat and dairy products processing and rural tourism, in the territory of the mentioned areas.

Results and Discussions

Based on the conducted research and on the examined sample of the previously mentioned, targeted group of farmers, the results were first obtained on the type of irrigation system that is most often used in agricultural holdings on the territory of the Republic of Serbia. Accordingly, it can be concluded that the most frequently used type of irrigation system is Surface irrigation with 66.70%, while the second in order is the Dripping irrigation system with 40% (Figure 3).

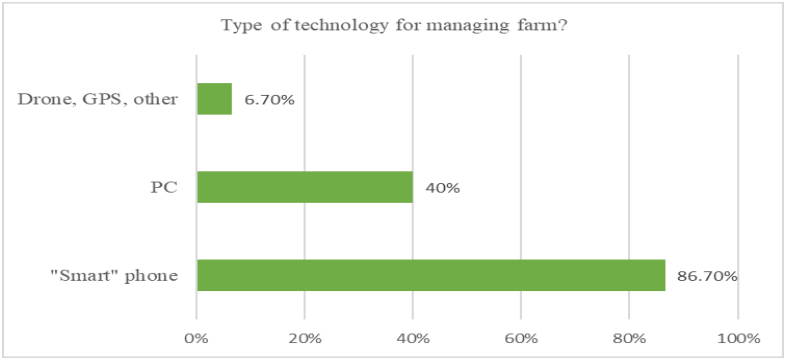
Figure 3. Irrigation type and type of mechanization for managing agricultural holdings – survey results



Source: Authors

On the other hand, the mechanization used in farms in the analysed regions of Serbia relates to tractors and attachment mechanisms in the amount of over 73%. The respondents estimated that the second most important type of mechanization is the combine harvester at 26.60%, which confirms the fact about the types of plant crops grown on the territory of the Republic of Serbia (Figure 3).

Figure 4. The most utilized types of technology in farm management in Serbia



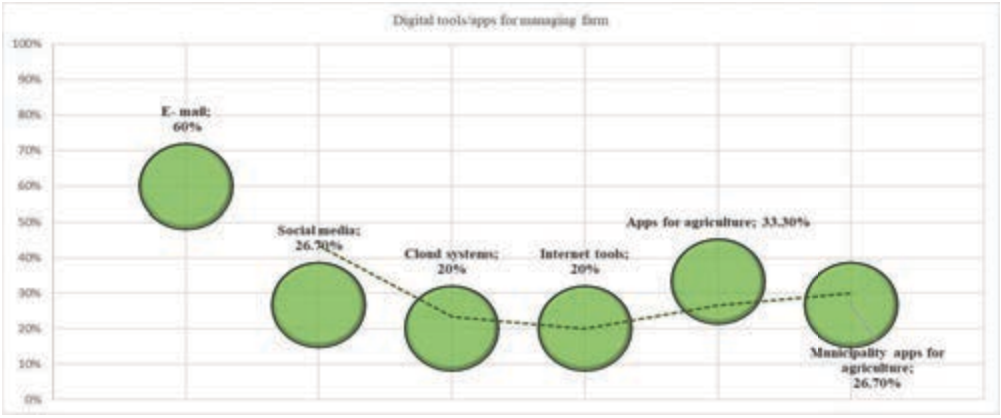
Source: Authors

Bearing in mind the digital readiness level of the analysed regions in which digital agricultural tools are used, based on the conducted research, the respondents evaluated the "Smart" phone as the device that is most used to valorise the ICT skill of the Serbian farmers. For mobile technology and its application support to experience full expansion, it is imperative that each country, or farm, shows a willingness to embrace digital innovations (Rađenović et al., 2020). In addition, high territorial coverage of the Internet and increased speed providers lead to the fact that the "Smart" phone represents the main device for managing digital tools of almost 87% of households (Figure 4).

One of the main goals of the mentioned research within the project of digitization of agriculture in Serbia and the formation of "smart" agricultural incubators, refers primarily to the evaluation of the application portfolio for the management of Serbian

agricultural holdings. In order to create a digitally sustainable and competitive environment, it is necessary to improve the digital skills of farmers, which will improve their productivity and eliminate unnecessary costs. Farmers' digital communication takes place via e-mail exchange of information in 60% of cases, while over 33% of farmers consider it useful to use applications as instruments for efficient management of daily farming activities. A significant percentage of the use of digital farming tools in the analysed regions of Serbia is made up of social networks (almost 27%), which represent a kind of medium both for the exchange of information and for the formation of digital "orbits" of farmers (Figure 5). Social networks are used to form various agro-communities where farmers join together to achieve greater competitive advantage and better price elasticity due to the easier availability of information on the market situation. In this way, better communication is achieved in the supply chain itself and the possibility of downtime due to inadequate flow of resources is reduced.

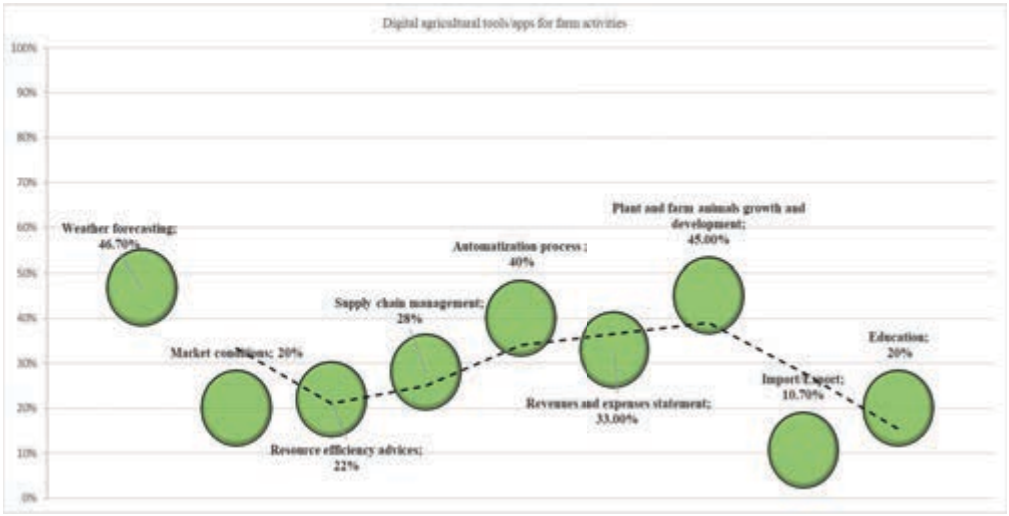
Figure 5. Digital agricultural application toolbox for farm managing in Serbia



Source: Authors

Digital instruments for managing activities on farms could be crucial to creating added value and long-term sustainability of a farm's operations. Therefore, in order to improve the business of the farm and increase its performance, digital tools are used for a large number of activities on farms that ultimately, and in the last resort increase the profitability and productivity of the farm. According to surveyed farmers, process automatization is one of the key activities where digital instruments are used the most (about 40%). Weather forecasting and Plant and farm animals' growth and development are directly related to farming activities, so the percentage of application use in this case is over 45%. Developing awareness of the importance of efficient resource allocation through the entire supply chain and among its stakeholders, implies the use of application solutions in these segments as well: Supply chain management (20%), Resource efficiency advices (22%), and Market conditions (20%). Observing the movement of financial indicators through a digital, applied economic barometer of the farm in the form of a single report is used by more than 33% of respondents (Figure 6).

Figure 6. Using digital agro-economic tools for farm activities among farmers in Serbian regions



Source: Authors

Conclusions

In recent decades, increasing attention has been paid to innovative approaches to improving the quality of agricultural products, which are largely based on the application of modern information technologies. The accelerated development of IT technologies and the digitalization of the agricultural sector provide space for the implementation of ideas based on the application of modern digital tools for data analysis, prediction, business simulation, budgeting and visualization of results, as well as the creation of digital agro-economic maps of farmers' businesses. For these reasons, it has been recognized that business analytics in agriculture can significantly increase the efficiency of this sector and improve the survival and progress of all stakeholders in the supply chain. Such a solution requires a large amount of information in order to increase the business performance of the farm in terms of greater productivity and profitability, as well as competitiveness in the market.

This research underscores the significant potential of digitalization to revolutionize agriculture in Serbia by enhancing efficiency, sustainability, and business performance. However, the findings highlight substantial barriers, including low digital literacy, inadequate infrastructure, and financial constraints. These challenges are particularly pronounced in less developed regions. Despite these obstacles, digital tools such as agro-economic maps show promise in optimizing resource use, reducing costs, and facilitating informed decision-making for farmers.

Therefore, the idea of creating a digital agro-economic map was born, in order to make decisions based on relevant indicators that would contribute to the optimization of the

farms' operations and the reduction of costs at all levels. The digital agro-economic map was designed with the aim of providing an economic prediction of business success, using existing business analytics tools. With the help of a digital agro-economic map, recommendations can be given to farmers on how to create efficient resource allocation and improve operations, instead of basing their business decisions solely on previous experience and acquired practices.

The position of all stakeholders in the supply chain can be improved by using adequate analytics. This scheme, based on timely analytics, also encourages improvements in product quality and sustainability. A digital agro-economic map has the potential to further contribute to answering questions such as: what resources help stakeholders achieve the best value for their products; what support they need to adopt newer methods and technologies; what market mechanisms should they provide; and how can these initiatives address gender and economic disparities? The proposed methodological framework classifies agribusiness analytics into several subcategories: supply chains; resources and markets; budgeting, pricing and financing; environmental and sustainability practices; government regulations and public policy; competitiveness; and import/export.

Based on the presented results to maximize the benefits of digital agriculture, key recommendations include: improving rural internet connectivity, increasing access to affordable digital tools, and implementing targeted education programs to enhance farmers' digital literacy. Policymakers should consider tailored strategies that address regional disparities and incentivize digital adoption. Collaboration between governments, technology providers, and agricultural stakeholders is essential for fostering a digitally inclusive and sustainable agricultural sector in Serbia.

Acknowledgements

This research was financially supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia (Contracts No. 451-03-66/2024-03/200371 and 451-03-66/2024-03/200148)

Conflict of interests

The authors declare no conflict of interest.

Reference

1. Bahn, R.A., Yehya, A.A.K., Zurayk, R. (2021). Digitalization for Sustainable Agri-Food Systems: Potential, Status, and Risks for the MENA Region. *Sustainability*, *13*(6), 3223. https://doi.org/10.3390/su13063223
2. Barabanova, Y. & Krzysztofowicz, M. (2023). *Digital Transition: Long-term Implications for EU Farmers and Rural Communities*, Publications Office of the European Union, Luxembourg, 2023, DOI:10.2760/093463, JRC134571.

3. Bocean, C.G. (2024). A Cross-Sectional Analaysis of the Relationship between Digital Technology Use and Agricultural Productivity in EU Countries. *Agriculture, 14*(4), 519. https://doi.org/10.3390/agriculture14040519

4. Confo, T.R.C., Djouhou, F.M.C., Hounhouigan, M.H., Dahouenon-Ahoussi, E., Avlesisi, F., & Sohounhloue, C.K.D. (2023). Recent advances in the use of digital technologies in agri-food processing: A short review. *Applied Food Research, 3*(2), 100329. https://doi.org/10.1016/j.afres.2023.100329

5. Ehlers, M.H., Huber, R. & Finger, R. (2021). Agricultural policy in the era of digitalization. *Food Policy, 100*, 102019. DOI: 10.1016/j.foodpol.2020.102019

6. EU CAP Network (2023). Innovation, knowledge exchange and EIP-AGRI under the new EU CAP Network. *Agrinnovation Magazine*, Issue 9. Luxembourg: Publications Office of the European.

7. European Commission (2020). *Farm to Fork strategy - for a fair, healthy and environmentally-friendly food system.* European Union.

8. European Network for Rural Development (2020). *Smart Villages and rural digital transformation*. Thematic Briefing. ENRD Brussel.

9. FAO (2020). *Smallholders and family farms in Serbia. Country study report 2019*. Food and Agriculture Organization of the United Nations, Budapest. Retrived from: https://openknowledge.fao.org/server/api/core/bitstreams/bd2829c1-75a1-43a8-aa2e-ed8a278630f8/content

10. FAO (2021). *Strategic Framework 2022-31*. The Food and Agriculture Organization of the United Nations. Retrieved from https://www.fao.org/strategic-framework/en

11. Flamini, M., & Naldi, M. (2022). Maturity of Industry 4.0: A Systematic Literature Review of Assessment Campaigns. *Journal of Open Innovation Technology Market, 8*(1), 51. https://doi.org/10.3390/joitmc8010051

12. Fuentes-Peñailillo, F., Gutter, K., Vega, R., & Carrasco Silva, G. (2024). Transformative Technologies in Digital Agriculture: Leveraging Internet of Things, Remote Sensing, and Artificial Intelligence for Smart Crop Management. *Journal of Sensors and Actuator Networks, 13*(4), 39. https://doi.org/10.3390/jsan13040039

13. Geng, W., Liu, L., Zhao, J., Kang, X., & Wang, W. (2024). Digtal Technologies Adoption and Economics Benefits in Agriculture: A Mixed-Methods Approach. *Sustainability, 16*(11), 4431. https://doi.org/10.3390/su16114431

14. Izveštaj o realizovanom istraživanju „*Nivo digitalne pismenosti i analiza potrebnog oblika podrške sa preporukama za poboljšanje nivoa digitalne podrške poljoprivrednicima*“, [*in English*: Research report “*The level of digital literacy and analysis of the required form of support with recommendations for improving the level of digital support for farmers*”]. Retrieved from https://www.agronews.rs/wp-content/uploads/2024/02/Izvestaj-o-istazivanju_Mladi-i-Mediji.pdf (September 18, 2024)

15. Jia, S. (2024). A Study of the Impact of Digital Technology on the Economics of Agricultural Export Trade. *Applied Mathematics and Nonlinear Sciences, 9*(1), 1-14. http://dx.doi.org/10.2478/amns-2024-2335

16. Jurjević, Ž., Bogićević, I., Đokić, D. & Matkovski, B. (2019). Information technology as a factor of sustainable development of Serbian agriculture. *Strategic management, 24*(1), 41-46. DOI:10.5937/StraMan1901041J

17. Karunathilake, E.M.B.M., Le, A.T., Heo, S., Chung.Y.S., & Mansoor, S. (2023). The Path to Smart Farming: Innovations and Opportunities in precision Agriculture. *Agriculture, 13*(8), 1593. https://doi.org/10.3390/agriculture13081593

18. Kovljenić, M., Škorić, J. Galetin, M. & Škorić, S. (2023). Digital Technology in agricuture: evidence from farms on the territory of AP Vojvodina. *Economics of Agriculture*, *70* (2), 583-596. DOI:10.59267/ekoPolj2302583K

19. Leng, X.C., & Tong, G.J. (2022). The Digital Economy Empowers the Sustainable Development of Chinas Agriculture-Related Industries. *Sustainaiblity, 14*(17), 10967. https://doi.org/10.3390/su141710967

20. McFadden, J., Casalini, F. & Antón, J. (2022). Policies to bolster trust in agricultural digitalisation - Issues note. OECD Food, Agriculture and Fisheries Paper, April 2022 n°175, OECD.

21. McFadden, J., Casalini, F., Griffin, T. & Antón, J. (2022). *The Digitalisation of Agriculture: A Literature Review and Emerging Policy Issues*. OECD Food, Agriculture and Fisheries Paper, April 2022 n°176, OECD.

22. Pérez-Pons, M.E., Parra-Dominguez, J., Plaza, M., Chamoso, P., & Alonso, R.C. (2020). Efficiency, profitability and productivity: Technological applications in the agricultural sector. *ADCAIJ: Advances in Distributed Computing and Artificial Intelligence Journal, 9*(4), 47-54. DOI: https://doi.org/10.14201/ADCAIJ2020944754

23. Rađenović, Ž., Krstić, B. & Marković, M. (2020). Smart farming in agricultural industry: Mobile technology perspective. *Ekonomika poljoprivrede*. 67 (3), 925-938. DOI: 10.5937/ekoPolj2003925R.

24. Republički zavod za statistiku (2019). *Anketa o strukturi poljoprivrednih gazdinstava, 2018: struktura, ekonomska snaga i marketing proizvoda poljoprivrednih gazdinstava.* [*in English*: Statistical Office of the Republic of Serbia (2019). *Farm Structure Survey, 2018*]. Retrieved from https://publikacije.stat.gov.rs/G2019/Pdf/G20196002.pdf (September 15, 2024)

25. Republički zavod za statistiku (2024). *Popis poljoprivrede 2023*. [*in English*: Statistical Office of the Republic of Serbia (2024). The Census of Agriculture 2023]. Retrieved from https://publikacije.stat.gov.rs/G2024/Pdf/G202422002.pdf (September 15, 2024)

26. Sektor za poljoprivednu politiku (2024). *Izveštaj o stanju u poljoprivredi u Republici Srbiji u 2023. godini: Knjiga I – Horizontalni pregled*. Ministartsvo poljoprivrede, šumarstva i vodoprivrede, Republika Srbija. [in English: Agriculture Policy Sector (2024). *Report on the state of agriculture in the Republic of Serbia in 2023: Book I - Horizontal overview*. Ministry of Agriculture, Forestry and Water Management, Republic of Serbia].
27. Site, D. P., & Salucci, M. V. (2006). *Third Annual Thematic Research Summary - Rural Transport.* The Transport Research Knowledge Centre, European Commission.
28. Službeni glasnik RS (2014). *Strategija poljoprivrede i ruralnog razvoja Republike Srbije za period 2014-2024. godine*. Službeni glasnik 85/14 od 12. avgusta 2014. godine. [in English: Official Gazette RS (2014). *Strategy for agriculture and rural development of Republic of Serbia for period 2014-2024*. Official Gazette 85/14 from August 12, 2014].
29. Subeesh, A., & Mehta, C.R. (2021). Automation and digitization of agriculture using artificial intelligence and internet of things. *Artificial Intelligence in Agriculture, 5*, 278-291. https://doi.org/10.1016/j.aiia.2021.11.004
30. Trendov, N. M., Varas, S. & Zeng, M. (2019). *Digital technologies in agriculture and rural areas – Status report*. Food and Agriculture Organization of the United Nations, Rome.
31. Zhou, X., Chen, T., & Zhang, B. (2023). Research on the Impact of Digital Agriculture Development on Agricultural Green Total Factor Productivity. *Land, 12*(1), 195. https://doi.org/10.3390/land12010195

THE IMPACT OF PRODUCT AND PROCESS INNOVATION AND TECHNOLOGICAL DIMENSIONS ON THE SUSTAINABLE COMPETITIVE ADVANTAGE OF MANUFACTURING COMPANIES

Dragana Vuković[1], Ana Dukić[2], Ana Urošević[3] Božo Ilić [4]

**Corresponding author E-mail: dvukovic@asss.edu.rs*

ARTICLE INFO

Original Article

Received: *29 December 2024*

Accepted: *20 January 2025*

doi:10.59267/ekoPolj2501241V

UDC 001.895:005.936.43]:339.137.2

Keywords:

product innovation, process innovation, technological innovation, sustainable competitive advantage

***JEL**: L11, L23, L86*

ABSTRACT

This study investigates the impact of product, process, and technological innovations on the sustainable competitive advantage of manufacturing companies. An empirical survey was conducted on a sample of 252 employees. The results reveal that product innovation positively influences market share and customer loyalty, while process innovation enhances cost efficiency and operational effectiveness. Moreover, the technological dimension not only directly contributes to competitive advantage but also moderates the relationship between product and process innovations, amplifying their beneficial effects. These findings underscore the strategic importance of investing in technological advancements to maximize the impact of product and process innovations. The study provides valuable insights into the synergistic effect of these innovations, offering practical implications for managers aiming to strengthen competitive positioning. By integrating technological advancements with product and process innovation strategies, companies can achieve long-term sustainability and economic success. The research contributes to the existing body of knowledge by demonstrating the moderating role of the technological dimension in fostering sustainable competitive advantage.

1 Dragana Vuković, skills teacher, Academy of Vocational Studies Šumadija, Department Aranđelovac, Josifa Pančića 11, 34300 Aranđelovac, Serbia, Phone: +381603224000, E-mail: dvukovic@asss.edu.rs, ORCID ID (https://orcid.org/0009-0007-3271-7312)

2 Ana Dukić, PhD, Professor, Academy of Vocational Studies Šumadija, Department Aranđelovac , Josifa Pančića 11, 34300 Aranđelovac, Serbia, Phone: +381, E-mail: adukic@asss.edu.rs, wORCID ID (https://orcid.org/0000-0003-2349-2805)

3 Ana Urošević, Assistant, Academy of Vocational Studies Šumadija, Department Aranđelovac, Josifa Pančića 11, 34300 Aranđelovac, Serbia, Phone: +381668586050, E-mail: aurosevic@asss.edu.rs, ORCID ID (https://orcid.org/0000-0002-1978-0321)

4 Božo Ilić, PhD, Professor, Academy of Vocational Studies Šumadija, Department Aranđelovac , Josifa Pančića 11, 34300 Aranđelovac, Serbia, Phone: +381646148305, E-mail: bilic@asss.edu.rs, ORCID ID (https://orcid.org/0000-0008-1315-8479)

Introduction

The success of a company, both in domestic and international markets, increasingly depends on its innovativeness. Innovation represents a means of achieving competitive advantage. Ogunkoya and others emphasize that competitive investment in innovation is akin to an arms race. Competition forces companies to innovate (Ogunkoya et al., 2024). Particularly noteworthy is the importance of technological innovation, a significant component of innovations, which is crucial for achieving the competitive advantage of any company (Chen et al., 2023). Through technological innovation, companies are enabled to change their market orientation and, in the case of significantly new technologies, to enter entirely new markets. The innovation process is based on creating new products through which the company achieves a competitive advantage. There is a strong correlation between new products and market behavior Li & Jin, 2023). New products help in capturing and retaining market share, as well as increasing profitability. In the case of more mature and well-known products, the increase in competitive sales arises not only from the ability to offer low prices but also from various non-price factors such as design, adaptability, and quality.

Competitiveness is not an immutable category. Once a competitive advantage is achieved, it is difficult to constantly maintain it and find ways to enhance it. One way to increase competitive advantage is based on increasing productivity through investment in innovations, investment in knowledge, and new technologies (Petrović et al., 2023). Product innovation refers to the introduction of a new or significantly improved product in terms of characteristics and purposes. It involves continuous improvements in technical specifications, components and materials, ease of use, and implemented software. Process innovation represents a type of technological innovation (Balaz et al., 2023). There is a strong connection between process innovation and product innovation. These two processes within a company are sometimes so intertwined that it is difficult to separate and observe them in isolation. When considering process innovation, it can be concluded that it involves improvements in the very process of product manufacturing.

This includes significant improvements in production methods, encompassing changes in equipment and software, techniques, or production organization, or in all these areas. Methods are strictly aimed at increasing the efficiency of the production process, i.e., reducing costs per unit of output. Essentially, the goal is to reduce input for the same output, which leads to increased efficiency as previously mentioned. Technological innovations can rarely be categorized, transferred, and applied in isolation. The usefulness of one invention is closely linked and conditioned by other complementary inventions, i.e., the introduction of technological innovation creates its dependency on other complementary areas. For successful implementation, it is necessary to carry out additional technological changes in the integral system where the desired effects are to be achieved.

Literature Review

Technological innovation acts as a catalyst in enhancing the favorable impact on the value of a company (Yusheng et al.,2023). Modern technologies save time and costs and improve the performance of companies, meet customer needs, and thereby achieve sustainable competitive advantage (Dhanora et al., 2020; Al-Mamary et al., 2020). Research conducted in China by Shi et al. (2018) on a sample of 201 manufacturing companies demonstrated that technological innovation primarily affects product quality and consequently the competitive advantage of companies (Shi et al., 2019). To innovate efficiently, companies collaborate with suppliers to develop modern technologies (Gao et al., 2023). Additionally, collaboration is carried out with research institutions. A study conducted on a sample of Chinese manufacturing companies using regression analysis proved that an increase in technological innovations leads to an increase in the value of the manufacturing chain and has a positive impact on the intelligent transformation of manufacturing companies. Moreover, the study showed that competitive advantage plays a moderating role in the dissemination of technological innovations (Yin et al., 2024).

Nilsson & Goransson (2021) define sustainable innovation as the creation of products, processes, management practices or business models that are new or significantly improved and that bring economic, social and environmental benefits. Rodríguez-Espíndola et al. (2022) point out that innovative practices can be integrated through sustainability at the product, process and organizational levels, with product innovations involving the introduction of improvements or completely new products or services to improve sustainable performance, while process innovations involve redesigning operations to reduce resource use, improve the way services are managed and introduce environmental efficiency into their activities.

It is interesting to observe the reverse relationship, i.e., whether the technological dimension has a moderating role in the relationship between innovation and competitive advantage, which is a derived goal of this paper. Manufacturing companies introduce innovations in logistics processes, thereby increasing efficiency. By introducing innovative changes in production processes, they improve product quality. The goal is to achieve maximum results with minimal investment. Implementing product innovations involves introducing product components with technical specifications and functions different from existing ones. The production process requires raw materials that contribute to the sustainable development of products. Additionally, the production process and the expansion of the product line depend on customer desires and needs. The purpose of the company is to implement changes that customers recognize in the market, enabling a superior market position for the company (Ogunkoya et al., 2024; Yusheng et al., 2023; Shi et al., 2018).

Wojtowicz et al. (2018) conducted research in Poland, where the results proved the positive impact of expenditure on innovative activities in the field of product and process innovations on economic outcomes in the manufacturing sectors (sales volume and gross added value). It is concluded that an important source of competitive

advantage should be the quality and functionality of products, the ability to meet individual customer needs. Quality management practices, such as leadership and top management support, training and employee participation, information and learning, and customer focus, positively affect the creation of product and process innovations.

Accordingly, Soltani & Modaresm (2022) emphasize that these practices should be incorporated into the business strategy, considering that the strategy of product and process innovation performance is a major driver of the competitive advantage of the company. In a study conducted by Henrique et al. (2023) on a sample of 5588 manufacturing companies from Latin American countries, the results showed that research and development as a prerequisite for innovativeness positively impacts product and process innovation.

On the other hand, research conducted on a sample of 238 Tunisian manufacturing firms by Khalifa (2021) shows that the impact of research and development is crucial in product innovation development, thereby enhancing the profitability of the company, but not in the development of production processes. Namely, the innovation of production processes impacts profitability only in combination with product innovation (Khalifa, 2021). Their incorporation undoubtedly leads to company profitability and other benefits. Orlovtseva & Gubanova (2023) point out that process innovations have a stronger impact on company performance than product innovations, which further indicates a greater commitment to process innovations, due to potential feedback.

The results of a study conducted by Canh et al. (2019) show that process and product innovations impact company performance in terms of market share. Additionally, the results indicate that investing in innovative activities requires time to make positive changes in profitability and can help gain customer loyalty (Canh et al., 2019). Lapple & Thorne (2019) in their study on a sample of 342 Irish manufacturing companies confirm the impact of innovations on economic sustainability, highlighting that economic gains depend on the level of innovations. It is evident that all the mentioned studies emphasize the importance of innovative endeavors for profitable business operations, resulting in the creation of sustainable competitive advantage.

Taneja et al. (2023) in their study emphasize that sustainable innovations viewed through products and processes have a positive impact on creating a reputation, or a green image, which further transmits a positive impact on performance. Vacchi et al. (2024) through the study, they emphasize the importance of aligning technological progress with environmental and social goals to achieve long-term sustainability and competitiveness. The authors Getnet Agazu & Amentie Kero (2024) emphasize that adopting innovation strategies is crucial for maintaining a competitive advantage in a dynamic business environment.

Savić & Ilić (2019) point out that strategies for achieving competitive advantage in agricultural production include innovations in production processes, resource optimization, and adaptation to market demands, that is, key elements involve improving product quality, implementing sustainable practices, and enhancing

efficiency by applying modern technologies and employee training. Authors Marković & Nikolić (2020) point out in their study that technological and process innovations, such as equipment modernization and production process improvements, contribute to a company's competitive position by increasing efficiency, reducing costs, and adapting to market demands. Similarly, Jovanović & Petrović (2021) in their study explore key factors that influence competitiveness, including resource efficiency, market access, and the application of technological innovations, with the results showing that modernization of production and increasing product quality significantly contribute to strengthening the position of agricultural enterprises in the market.

Based on the review of the aforementioned research, the following main hypotheses are formed:

H1: Product innovation has a positive and statistically significant impact on the sustainable competitive advantage of companies.

H2: Process innovation has a positive and statistically significant impact on the sustainable competitive advantage of companies.

H3: The technological dimension has a positive and statistically significant impact on the sustainable competitive advantage of companies.

Derived hypothesis:

H4: The technological dimension has a moderating role in the relationship between product/process innovations and sustainable competitive advantage.

Methodology

The research was conducted in the Central Serbia region from July 1 to July 13, 2024. The sample consists of 252 employees, segmented by gender, age, educational level, and work position in the manufacturing company. Table 1 presents the sample structure, indicating that the sample consists of 57% male participants and 43% female participants, aged between 36 and 55 years (52%), and mostly having a high level of education (54%). A larger portion of the sample participants hold managerial positions in the manufacturing company (59%).

Table 1: Sample characteristics

Demographic characteristicS		**Numerically**	**%**
GENDER	Female Male	108 144	43% 57%
AGE	18-25 26-35 36-45 46-55 56+	35 47 68 63 39	14% 19% 27% 25% 15%
EDUCATION	Elementary Middle Higher	17 98 137	7% 39% 54%
WORKING POSITION	Leadership	149	59%
	Non-leadership	103	41%

Source: Author's research

For the research, an online survey was used and distributed electronically. The questionnaire consisted of relevant statements grouped into four factors, as shown in Table 2 (product innovations, process innovations, technological dimension, and sustainable competitive advantage). A Likert scale was used in the study, and the obtained data were processed using IBM SPSS. Factor analysis, correlation analysis, regression analysis, as well as moderation analysis were used to measure the impact of the technological dimension on the relationship between product/process innovations and the sustainable competitive advantage of manufacturing companies.

Table 2: Formed factors

	Factor	**Origin**
1. The company develops new products with technical specifications and functions that differ from the existing ones and are adapted to the market.	PRODUCT INNOVATION	Thi, et al., 2023; Gil-Saura et al., 2023; Nikolić et al., 2022; Marin Garcia et al., 2023; Shi et al., 2018.
2. The company improves existing products by adding new components, which are different from the existing ones.		
3. The company involves customers in the product development process, adapting the product design to their needs		
4. The company is expanding the number of product lines.		
5. The company uses raw materials that contribute to sustainable product development.		

	Factor	Origin
6. The company introduces innovations in logistics processes.	PROCESS INNOVATION	Gil-Saura et al., 2023; Nikolic, et al., 2022; Marin-Garcia et al., 2023; Shi et al.,2018.
7. The company increases economy in logistics processes.		
8. The company improves the quality of output (highway) by introducing changes in production processes, techniques, machines and software.		
9. The production process has been modified in order to reduce the consumption of resources (raw materials, energy, etc.).		
10. The company introduces new processes that enable the recovery of end-of-life products for recycling		
11. The company introduces improved information technology/software for product manufacturing.	TECHNOLOGICAL DIMENSION	Shi et al., 2018; Al-Mamary et al., 2020.
12. The company cooperates with suppliers on the development of technologies.		
13. The company cooperates with scientific research institutions on the development of technologies.		
14. The company effectively uses its technological resources, which contribute to competitive advantage.		
15. The company introduces the latest technological solutions, i.e. invests in technology.		
16. The company has a higher level of productivity compared to its competitors.	SUSTAINABLE COMPETITIVE ADVANTAGE	Thi et al., 2023; Al-Mamary et al., 2020.
17. The quality of the company's products is better than the quality of competitors' products.		
18. The company has a superior position on the market.		
19. The company introduces changes that are recognized and appreciated by clients/customers.		
The innovations introduced by the company were a springboard for further development.		

Source: Author's research

Research Results and Discussions

As previously mentioned, factors were formed: product innovations, process innovations, technological dimension, and sustainable competitive advantage, and a reliability analysis was conducted to determine whether there is internal consistency among the statements that constitute these factors. The results of the reliability analysis are presented in Table 3. Based on the value of the Cronbach's alpha coefficient, it can be concluded that there is an adequate level of reliability for all factors. The highest degree of internal consistency of the statements occurs in the factor Sustainable Competitive Advantage (highest Cronbach's alpha value – 0.947), while the lowest degree of internal consistency of the statements occurs in the factor Product Innovations (lowest Cronbach's alpha value – 0.858).

Table 3. Results of factor analysis

Factors	AS	SD	Cronbach's alpha
Product innovation	4.493	0.605	0.858
Process innovation	4.537	0.551	0.867
Technological dimension	4.472	0.672	0.919
Sustainable competitive advantage	4.444	0.736	0.947

Source: Author's research

The next analysis in the research is a correlation analysis to determine the degree of quantitative agreement in the variations of the created factors (Table 4). The results show that there is a strong positive correlation between all observed factors, with the correlation values being statistically significant at the 0.01 level. The highest degree of correlation occurs between the factors of the technological dimension and sustainable competitive advantage, due to the highest value of Pearson's correlation coefficient, 0.908, indicating the strongest correlation.

Table 4. Results of correlation analysis

	Product innovation	Process innovation	Technological dimension	Sustainable competitive advantage
Product innovation	1	0.846**	0.758**	0.799**
Process innovation	0.846**	1	0.861**	0.885**
Technological dimension	0.758**	0.861**	1	0.908**
Austainable competitive advantage	0.799**	0.885**	0.908**	1

Source: Author's research

** Significance at the $p < 0.01$ level

The effects of the independent variables, namely product and process innovations, as well as the technological dimension, on sustainable competitive advantage were tested through multiple regression analysis (Table 5). Based on the obtained value of

the coefficient of determination (R^2=0.870; p < 0.01), it is concluded that 87% of the variability in sustainable competitive advantage is explained by the created factors (product innovations, process innovations, and the technological dimension). The obtained VIF coefficient value indicates that multicollinearity does not occur.

The regression analysis determined that product innovation (β=0.118; p<0.01) and process innovation (β=0.312; p<0.01) have a statistically significant positive impact on sustainable competitive advantage, which confirms hypothesis H1 and hypothesis H2. Process innovation has a greater impact on sustainable competitive advantage (β=0.312) compared to product innovation (β=0.118), as indicated by the higher β coefficient value. Additionally, multiple regression analysis showed that the technological dimension (β=0.550; p<0.01) has a significant impact on sustainable competitive advantage, confirming hypothesis H3. Based on the value of the β coefficient, it can be concluded that the technological dimension has the greatest impact on sustainable competitive advantage compared to product and process innovation (β=0.550).

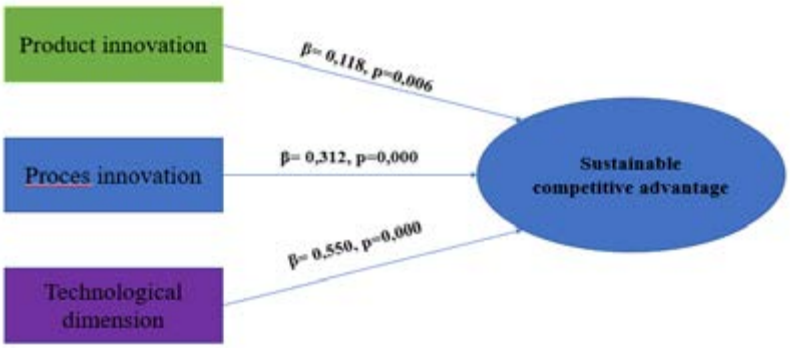
Table 5. Multiple regression analysis

	Sustainable competitive advantage			
Variable	β	T	p	VIF
Product innovation	0.118	2.747	0.006**	3.552
Process innovation	0.312	5.644	0.000**	3.838
Technological dimension	0.550	12.163	0.000**	3.904
	R^2 = 0,870; F = 554,139 (p=0,00 < 0,01)			

Source: Author's research

** The value is significant at the p < 0.01 level

Figure 1. Results of the regression analysis



Source: Author's research

After examining the main effects of the independent variables (product innovation, process innovation, technological dimension) on sustainable competitive advantage, interaction effects were also determined. For this purpose, a moderation regression

analysis was conducted, with the technological dimension used as the moderator. The results of the moderation regression analysis are shown in Table 6. The results indicate that 88.7% of the variability in sustainable competitive advantage is explained by this regression model, as evidenced by the coefficient of determination value of $R^2 = 0.887$. This value is significant at the 0.01 level. The VIF coefficient value indicates that multicollinearity does not occur.

The technological dimension has a statistically significant negative moderating effect on the relationship between product innovation and sustainable competitive advantage ($p=0.003 < 0.01$), as indicated by the negative β coefficient value ($\beta=-0.147$). This means that as the technological dimension strengthens, the relationship between product innovation and sustainable competitive advantage weakens (for example, if a company does not frequently introduce new product lines, there will still be a competitive advantage due to the strength of the existing technological dimension).

The results further show that the technological dimension has a statistically significant positive moderating role in the relationship between process innovation and sustainable competitive advantage ($p=0.000 < 0.01$), with a positive β coefficient value ($\beta=0.272$). This indicates that as the technological dimension strengthens, the relationship between process innovation and sustainable competitive advantage also strengthens.

Table 6. Moderation regression analysis

	Sustainable competitive advantage			
Variable	β	t	p	VIF
Product innovation	0.633	13.769	0.000**	4.609
Process innovation	0.056	1.065	0.288	5.936
Technological dimension	0.391	6.870	0.000**	5.061
Technological dimension * Product innovation	-0.147	-2.966	0.003**	5.358
Technological dimension * Process innovation	0.272	5.854	0.000**	4.707
	$R^2 = 0,887$; F = 387,573 (p <0,01)			

Source: Author's research

** The value is significant at the $p < 0.01$ level

Conclusions

The analysis of the results determined that product, process, and technological innovations have a statistically significant positive impact on sustainable competitive advantage. Product innovations contribute to increased market share and customer loyalty by introducing new and improved products. Process innovations enhance cost efficiency and operational effectiveness, leading to a stronger competitive position. The technological dimension, on the other hand, not only directly influences competitive advantage, but also has a moderating effect on the relationship between product and

process innovation and sustainable competitive advantage. These findings highlight the importance of continuous investment in technological advancements as a strategic approach to maintaining and enhancing competitive advantage.

The theoretical implication of the study involves gaining new insights into the field of innovation and sustainable competitive advantage, contributing to a better understanding of the synergistic effect of product, process, and technological innovations on competitive advantage. The originality of this research lies in acquiring new knowledge about the moderating role of the technological dimension, specifically whether the technological dimension alters the strength of the relationship between innovations and the sustainable competitive advantage of manufacturing companies.

The obtained results provide practical recommendations for business owners and managers, emphasizing the need for strategic investment in product and process innovations supported by technological advancements. This approach not only enhances competitive positioning but also ensures cost efficiency, market responsiveness, and long-term sustainability.

The study faces limitations in terms of spatial scope, sample size, and the fact that only three types of innovations were considered, despite the existence of various different types of innovations. This indicates that future research could be conducted over a longer period and include a larger sample. Research could also be extended to other regions of the Republic of Serbia. Future studies might include other types of innovations, such as marketing innovations, and incorporate sustainability aspects into the research. Another suggestion for future research is to consider another variable as a potential moderator, such as image.

Conflict of interests

The authors declare no conflict of interest.

References

1. Al-Mamary, H.S.J., Abdulrab, M., Alwaheeb, M.A., Shamsuddin, A., & Jazim, F., (2020). The impact of technological capability on manufacturing companies: *A review*, *WILEY*, 1-12. DOI: 10.1002/pa.2310
2. Balaz, V., Jeck, T., & Balog, M. (2023). Firm performance over innovation cycle: evidence from a small European economy, *Journal of Innovation and Entrepreneurship*, 2-23. https://doi.org/10.1186/s13731-023-00298-9
3. Canh, N.T., Liem, N.T., Thu,P. A., & Khuong, N.V. (2019). The Impact of Innovation on the Firm Performance and Corporate Social Responsibility of Vietnamese Manufacturing Firms. *MDPI*, https://doi:10.3390/su11133666
4. Chen, T.C, Subrahmanyam, S., Singh, K, Aravindhan, S., Sivaraman R., & Iswanto A.H. (2023). Prioritizing factors affecting regional competitiveness in industrial clusters. *International review*, No.1-2, 99-112.

5. Dhanora, M., Danish, M.S., & Sharma, R. (2020). Technological innovations and firms' productivity in new patent regime: Evidences from Indian pharmaceutical industry. *Journal of Public Affairs*, Vol. 21, No. 1, 1-11. https:// doi.org/10.1002/pa.2136
6. Gao, X., Li, C., Elahi, E., Abro, I.M., & Cui, Z. (2023). Technological Innovation, Product Quality and Upgrading of Manufacturing Value Chain: Empirical Evidence from China, *MDPI*, 2-19. https://doi.org/10.3390/su15097289
7. Getnet - Agazu, B. & Amentie - Kero, Ch. (2024). Innovation strategy and firm competitiveness: a systematic literature review. *Journal of Innovation and Entrepreneurship*, Vol. 13, No.24, 1-17., http://dx.doi.org/10.1186/s13731-024-00381-9
8. Gil-Saura, I., Ruiz-Molina, M. E., Marín-García, A., & Michel, G. (2023). Sustainability-oriented commerce innovation: How does it influence consumer satisfaction?. *International Journal of Retail & Distribution Management*, Vo. 51, No.3, http://dx.doi.org/10.1108/IJRDM-07-2022-0267
9. Henrique, R.O., Crespo, F.A., Geldes, C., Ferreira, T.A., & Vergara, M.C. (2023). Impact of R&D on the Innovation of Products and Processes in Latin Countries, *MDPI*, 2-14. https://doi.org/10.3390/axioms12020149
10. Jovanović, M., Petrović, S. (2021). Analysis of competitiveness factors of agricultural enterprises in Serbia. *Agricultural Economics*, Vol. 68, No. 2, 123-135., DOI: 10.5937/ekoPolj2102123J
11. Khalifa, A.B. (2021). Impact of research and development (R&D) and information, and communication technology (ICT) on innovation and productivity evidence from Tunisian manufacturing firms. *Economics of Transition and Institutional Change*, Vol. 31, No. 1, 341–361. DOI: 10.1111/ecot.12340
12. Lapple, D. & Thorne, F. (2019). The Role of Innovation in Farm Economic Sustainability: Generalised Propensity Score Evidence from Irish Dairy Farms, *Journal of Agricultural Economics*, Vol. 70, No. 1, 178–197. https://doi: 10.1111/1477-9552.12282
13. Li, D., & Jin, C. (2023). Study on the impact of R&D input intensity on technological innovation output - Based on data from China's high technology industry Chengguo. *Plos One*, 1-16. https://doi.org/10.1371/journal.pone.0292851
14. Marin-Garcia, A., Gil-Saura, I., & Ruiz-Molina, M.E., Berenguer-Contri, G. (2023). Capturing consumer loyalty through technological innovation and sustainability: the moderating effect of the grocery commercial format. *British Food Journal*, Vol. 125 No. 8,2764-2784. https://doi.org/10.1108/BFJ-12-2021-1317
15. Marković, L., & Nikolić, D. (2020). The impact of innovations on the competitiveness of agribusiness. *Economics of Agriculture*, Vol. 67, No. 4, 456-468., DOI: 10.5937/ekoPolj2004456M
16. Nikolić, J., Mirić, M. & Zlatanović, D. (2022). Does ownership type matter for innovativeness and learning orientation? Empirical evidence from Serbai. *Teme*, Vol. XLVI, No 4, 995−1009. https://doi.org/10.22190/TEME211001052N

17. Nilsson, F., & Goransson, M. (2021). Critical factors for the realization of sustainable supply chain innovations - Model development based on a systematic literature review. *Journal of Cleaner Production 296,* 3-13., https://doi.org/10.1016/j.jclepro.2021.126471

18. Ogunkoya, O.A., Hassan, B.A. Soremekun, O.E., & Ogundele, A.M. (2024). The impact of technological innovation on firm performance in Nigeria consolidated breweries plc. *Modern management review*, Vol. 29, No. 1, 31-42. DOI: 10.7862/rz.2024.mmr.03 CC-BY 4.0

19. Orlovtseva O.M., & Gubanova E.V. (2023). The impact of product and process innovations on financial results: An empirical study of Russian companies. *Strategic Decisions and Risk Management,* 14(3), 278-291. DOI: 10.17747/2618-947X-2023-3-278-291.

20. Petrović, T., Paunović, V., & Komatina N. (2023). Efqm and business model relation effect on performance of manufacturing enterprises. *International review*, No.1-2, 39-47.

21. Rodríguez-Espíndola, O., Cuevas-Romo, A., Chowdhury, S., Díaz-Acevedo, N., Albores, P., Despoudi, S., Malesiosf, C., & Dey, P. (2022). The role of circular economy principles and sustainable-oriented innovation to enhance social, economic and environmental performance: Evidence from Mexican SMEs. *International Journal of Production Economics 248,* 2-14., https://doi.org/10.1016/j.ijpe.2022.108495

22. Savić, V., & Ilić, M. (2019). Strategy for achieving competitive advantages in agricultural production. *Agricultural Economics*, Vol. 66, No. 3, 321-333. DOI: 10.5937/ekoPolj1903321S

23. Shi, L.,Wang, X., Sun, H., He, Z. (2018). The impact of technological innovation on product quality: the moderating role of firm size. Total Quality Management & Business Excellence, Vo 29, No. 7, 746-761. https://doi.org/10.1080/14783363.2016.1233810

24. Soltani, M.D., & Modaresm T. (2022). The impact of total quality management on firm competitiveness by the mediating role of product and process innovation. *Journal of Business Administration Research*, Vol. 14, No. 28, 1-30.

25. Taneja, A., Goyal, V., & Malik, K. (2023). Sustainability-oriented innovations – Enhancing factors and consequences. *Corp Soc Responsib Environ Manag*., 30, 2747–2765.

26. Thi, U. N., Van, M. H., Mahmud, I., & Thuy, L. V. T. (2023). Innovation and the Sustainable Competitive Advantage of Young Firms: A Strategy Implementation Approach. *Sustainability*, *15*(13), 10555. https://doi.org/10.3390/su151310555

27. Vacchi, M., Siligardi, C., & Settembre-Blundo, D. (2024). Driving Manufacturing Companies toward Industry 5.0: A Strategic Framework for Process Technological Sustainability Assessment (P-TSA). *Sustainability*, 16(2), 695; https://doi.org/10.3390/su16020695

28. Wojtowicz, R.E., Laskowska, I., & Grzelak,M.M. (2018). Assessment of the relationship between innovations and economic performance of manufacturing enterprises in *Poland. Acta Sci. Pol. Oeconomia*, Vol.17, No. 4, 171–178. DOI: 10.22630/ASPE.2018.17.4.64

29. Yin, Y., Zhang, Z.,D.K., & Wen, X. (2024). Sustainable Influence Mechanism of Technological Innovation Diffusion on Intelligent Transformation of Manufacturing Enterprises Based on Competitive Advantage and Value Chain Can Regulate Mediation Effect Analysis. *Polish Journal of Environmental Studies*, Vol. 33, No. 2, 1429-1441. DOI: 10.15244/pjoes/173439

30. Yusheng, K., Andrew A., Alesa, N., & Maxwell K. (2023). The Moderating Role of Technological Innovation on Environment, Social, and Governance (ESG) Performance and Firm Value: Evidence from Developing and Least-Developed Countries. *MDPI,* 2-16. https://doi.org/10.3390/su151914240

COMPETITIVENESS OF THE AGRICULTURAL SECTOR OF SOUTHEAST EUROPE: THE WESTERN BALKANS VS. EUROPEAN UNION

Miloš Dimitrijević[1], Vesna Mrdalj[2], Miljan Leković[3]

**Corresponding author E-mail: mdimitrijevic@kg.ac.rs*

ARTICLE INFO

Original Article

Received: *02 February 2025*

Accepted: *25 February 2025*

doi:10.59267/ekoPolj2501255D

UDC 339.137.2:631(497)

Keywords:

agricultural competitiveness, productivity, yields, Revealed Comparative Advantage, Unit Values, Southeast Europe vs. European Union.

***JEL**: O13, Q10, Q18, R11*

ABSTRACT

Despite its importance, the state of the agricultural sector in Southeast Europe is not at a satisfactory level. The goal of the paper was to examine the impact of agricultural competitiveness on economic development and to identify the parameters that contribute to its improvement. The Revealed Comparative Advantage index was employed to assess the comparative advantage, while the Unit Values index was used to examine the quality of important agricultural products. Ordinary Least Squares regression was applied to examine the impact of agricultural competitiveness on economic development. Kruskall-Wallis test was used to compare important factors that affect this competitiveness. The results indicate that Southeast Europe generally has a competitive agricultural sector. Republic of Serbia stands out in terms of competitiveness, but it is primarily driven by low productivity, prices and yields. Enhancing the value-added of agricultural products is crucial for boosting trade, strengthening agricultural competitiveness and fostering economic development.

Introduction

In the context of the open market and strong competition, for countries undergoing the European Union (EU) integration process, such as those in Southeast Europe (SEE), i.e. Western Balkans (WBs), one of the key challenges is improving the agriculture

1 Miloš Dimitrijević, PhD, Research Associate, University of Kragujevac, Faculty of Economics, Liceja Kneževine Srbije 3, 34000 Kragujevac, Serbia, Phone: +381659890625, E-mail: mdimitrijevic@kg.ac.rs, ORCID ID (https://orcid.org/0000-0002-7922-8299)

2 Vesna Mrdalj, Associtaed Professor, University of Banja Luka, Faculty of Agriculture, Bulevar vojvode Petra Bojovića 1 A, 78 000 Banja Luka, Bosnia and Herzegovina, Phone: + 387 51 330 – 927, E-mail: vesna.mrdalj@agro.unibl.org, ORCID ID (https://orcid.org/0000-0002-7041-7202)

3 Miljan Leković, PhD, Associate Professor, University of Kragujevac, Faculty of Hotel Management and Tourism Vrnjačka Banja, Vojvođanska 5A, 36210 Vrnjačka Banja, Serbia. Phone: +381 64 358 23 04. E-mail: m.lekovic@kg.ac.rs, ORCID ID (https://orcid.org/0000-0002-4952-3991)

sector competitiveness. The significance of agricultural sector for the WBs, is reflected in its high contribution to gross domestic product (GDP) (e.g., Albania: 16.98%, Bosnia and Herzegovina: 4.83%, Montenegro: 6.04%, Serbia: 5.34%, North Macedonia: 7.28%) and employment (e.g., Albania: 34.93%, Bosnia and Herzegovina: 16.87%, Montenegro: 7.16%, Serbia: 13.57%, North Macedonia: 9.70%). Comparing these indicators available for 2022 (WDI, 2024) with the other EU countries of SEE, as well as EU, particularly the sector's share in GDP (Bulgaria: 3.71%, Croatia: 3.39%: Greece: 3.75%, Slovenia: 1.71%, Romania: 3.81%, EU: 1.68%) and employment rates (Bulgaria: 6.45%, Croatia: 5.90%: Greece: 11.16%, Slovenia: 4.31%, Romania: 18.01%, EU: 3.99%) it becomes evident that the importance of agriculture for the economies of these countries is significantly greater than in the EU. Also, these indicators have a greater importance in relation to other sectors and developed countries (Dimitrijević et al., 2022; Pantović et al., 2022).

Despite its significance for the economies of these countries, the sector faces numerous structural challenges, such as the small average size of farms, fragmented land holdings, insufficient equipment and obsolete agricultural technology, low productivity as reflected in yields per hectare and livestock head, and an unfavourable export structure dominated by raw materials rather than products with higher value added. The importance of estimation of revealed comparative advantages (RCA) for SEE and WBs has been recognised by numerous authors.

Some studies have confirmed that the SEE, except Albania, have comparative advantages in the agri-food sector compared to the world market, measured by RCA index. On the other hand, agricultural productivity significantly affects the competitiveness of the agricultural sector (Matkovski, et al., 2019). WBs, except Albania, have comparative advantages in the agri-food sector. The Republic of Serbia stands out among them with the greatest comparative advantage in this sector (Matkovski et al., 2021).

Considering the importance of agriculture for WBs, special importance should be given to this sector in the EU integration. The agricultural productivity and yields of the WBs lag significantly behind the EU. Also, these countries have high prices of agricultural products, which makes them prices uncompetitive. All this leads to relatively low competitiveness of the WBs agricultural sector. Only the Republic of Serbia stands out as the only net producer of agricultural and food products (Volk et al., 2012). The Republic of Serbia is the leader among WBs in terms of agricultural production and export, which on the other hand has a positive impact on the economic development of these countries. WBs should increase the competitiveness of the agricultural sector by increasing the productivity of agriculture, but also by improving the structure of exports, given that this structure is dominated by products of the lower stages of processing, cereals, fruits and vegetables. Despite the competitiveness of the WBs agricultural sector (except Albania), it is lower compared to the EU. The main reasons for this are the degree of processing of these products, unsatisfactory quality and quantity, fluctuations, as well as low price competitiveness (Dimitrijević et al., 2023).

The most important agricultural export sectors of the Republic of Serbia are cereals and fruit. These sectors achieve a competitive advantage, measured by the Revealed Comparative Advantage (RCA) index. However, this competitiveness is not sustainable considering that it is based on a low price policy or inadequate product quality. That is why the export structure must change in the direction of products with a higher degree of processing and value-added (Dimitrijević et al., 2023a). The quality of agricultural products has a very important importance and influence on the export and competitiveness of the agricultural sector. The most important export products within these agricultural sectors (cereals and fruit) are corn, frozen fruit and apples. In the case of corn, the cost side dominates, i.e. production costs, while in the case of frozen fruits and apples, the quality of the products stands out in their competitiveness, measured by the Unit Values (UV) index. In the case of corn, import prices are higher than export prices, which means that the value coverage of imports by exports is lower than the quantitative coverage of imports by exports. In the case of products where quality dominates (frozen fruit and apples), the situation is the opposite. Products, where quality dominates, have a positive impact on exports and the economic development of the Republic of Serbia, unlike products where this is not the case (corn), which is exported in almost the largest quantities of all other agricultural products (Dimitrijević et al., 2023b). It is concluded that for products that are of good quality, the yields and quantities that are exported are small, while the competitiveness of products that are exported in larger quantities is based on low prices, which cannot be a sustainable solution for preserving the competitiveness of these products and the entire agricultural sector.

There is a pronounced gap between WBs and EU, especially in agricultural productivity. The countries in this part of Europe are agricultural countries with low productivity and prices of agricultural products. These unfavorable trends in agriculture have a negative impact on both the competitiveness of agriculture and the entire economy. Bearing in mind that the EU excels in terms of productivity in agriculture, the quality and quantity of agricultural production, as well as healthy food, it is necessary for these countries to reform and harmonize their agricultural policy in line with the Common Agricultural Policy (CAP) EU (Simonović et al., 2019). One of the goals of the WBs is to join the EU, which implies the harmonization of the agricultural policy of these countries with the CAP EU (Erjavec et al., 2021).

Although the EU is distinguished by the competitiveness of the agricultural sector, there is still a notable difference between the old and new EU members. Therefore, structural transformation should be carried out in many new EU members in the direction of increasing labor productivity, as an essential component of the competitiveness of agriculture (Nowak & Różańska-Boczula, 2021).

Given the existing studies on this topic, the subject of the paper is to examine the competitiveness of the agricultural sector of the SEE, as well as to make a comparison between non-member and EU member countries and the EU, thereby contributing further to the understanding of their agricultural competitiveness. Considering that Serbia stands out as one of the leading countries in SEE, i.e. Western Balkan, in terms of overall

economic progress, including the agro-food sector, towards EU integration than all other countries, two additional hypotheses have been defined in this paper for it.

The goal of the paper was to determine the impact of the agricultural sector competitiveness on economic development, as well as to determine the parameters that contribute to its competitiveness and compare the candidate countries for EU membership with the EU. Based on the subject and goal of the research, the following research hypotheses were set:

H_1: The most Southeast Europe countries have a competitive agricultural sector.

H_2: The competitiveness of the agricultural sector in Southeast Europe and European Union significantly affects economic development.

H_3: The Republic of Serbia has the most competitive agricultural sector in Southeast Europe.

H_4: Competitiveness of the agricultural sector of the Republic of Serbia is not sustainable.

Materials and methods

The research was conducted for the period from 2006-2023 based on the availability of data. The research was conducted on a sample of SEE: Serbia, Bosnia and Herzegovina, Montenegro, North Macedonia, Albania, Bulgaria, Romania, Slovenia, Croatia and Greece. Such a sample was chosen to bear in mind that the first five countries are countries that are candidates for the EU, as WBs, and the other five are EU member countries. For this reason, the EU is also included in the sample.

The research was conducted in several steps. In the first step, the competitiveness of the observed countries was determined and compared to the EU. Comparative advantage is often used as a measure of competitiveness. This index is known as the Revealed Comparative Advantage Index (RCA). The Balassa index is often used for comparative advantage analysis and this RCA index is constructed in the following form (Balassa, 1965):

$$RCA = \left(\frac{Xij}{\sum iX} ij\right) / \left(\frac{Xi}{\sum iXi}\right) \qquad \text{за i= 1, 2 ...., I; j=1, 2, ..., J} \qquad (1)$$

where X_{ij} is the export of product j from country i, and $/\sum_i X_{ij}$ is the total export of country i; X_i is the world export of that product, and $/\sum_i X_i$ is the total world export. The country has a revealed comparative advantage if RCA > 1, and a comparative disadvantage if RCA < 1.

The second part of the research refers to determining the impact of the competitiveness of the agricultural sector of the observed countries on economic development. Ordinary Least Squares (OLS) regression was used for this research. For this part of the research, assumptions related to the stationarity of time series, then multicollinearity between variables which determined the research model (no multicollinearity between variables), as well as autocollinearity and heteroscedasticity of the model (cross-section dependence) were examined. The Unit Root test was used to test stationarity. ADF -

Fisher Chi-square showed that all variables in the model are stationary (RCA - statistic 38.6116, prob. 0.01; trade - statistic 67.5110, prob. 0.00; agr_value - statistic 33.8811, prob. 0.05), except for the dependent variable GDP (statistic 6.07, prob. 0.99), which is why it is differentiated at the first level, thus its stationarity was obtained (statistic 104.195, prob. 0.00). The Durbin-Watson test showed that there is no autocollinearity in the model (1.67), while the Breusch-Pagan, i.e. cross-section dependence test showed that there is heteroscedasticity of the model (statistic 18.77, prob. 0.00), which was overcome by using cross-section SUR for the wight model (statistic 49.57, prob. 0.68), which resulted in homoscedasticity of the model.

The following regression equation was used for this research:

$$GDP_{i,t} = \alpha + \beta_1 RCA_{i,t} + \beta_2 trade_{i,t} + \beta_3 agr\_value_{i,t} + \varepsilon_{i,t} \quad (2)$$

The third part of the research refers to the comparison of competitiveness, but also productivity, yield, as well as price determined through the UV index, which is also used as a measure of quality, between the observed countries. As a measure of product quality, the UV (unit values) index is used, which represents the share of value exports in quantity (Fischer, 2010):

$$UV^k_{ct} = \text{Export value}_{ct} / \text{Exported quantity}, \quad (3)$$

where k represents the country, c is the product and t is the year.

For this part of the research, and to compare the observed indicators between countries, the Kruskall-Wallis test for comparison groups was used.

Table 1. presents an overview and description of the variables used in the research.

Table 1. Variable definition

Label	Definition	Source
RCA	Revealed Comparative Advantage index	Authors' research based on ITC, 2024
UV_cereals	Unit Values for cereals (Export Value 1000 USD/ Export Quantity t)	Authors' research based on FAOSTAT, 2024
UV_fruit	Unit Values for fruit (Export Value 1000 USD/ Export Quantity t)	Authors' research based on FAOSTAT, 2024
yield_cereals	Cereals, primary Yields (kg/ha)	FAOSTAT, 2024
yield_fruit	Fruit Primary Yields (kg/ha)	FAOSTAT, 2024
agr_pw	Agriculture, forestry, and fishing, value added per worker (constant 2015 US$) - Value added per worker is a measure of labor productivity—value added per unit of input.	WDI, 2024
trade	Trade (% of GDP) - Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	WDI, 2024
agr_value	Agriculture, forestry, and fishing, value added (current US$)	WDI, 2024
GDP	GDP (current US$)	WDI, 2024

Source: Authors' research

Results

The first part of the research aimed at determining the competitiveness of the agricultural sector of SEE and EU, which the following Table 2 showed.

Table 2. Competitiveness of the agricultural sector (RCA) of SEE and EU

Years	Serbia	Bosnia and Herzegovina	Montenegro	North Macedonia	Albania	Bulgaria	Romania	Slovenia	Croatia	Greece	EU
2006	3.23	1.00	1.49	2.72	1.41	1.46	0.57	0.52	1.66	3.29	1.28
2007	2.97	0.98	1.39	2.18	1.21	1.41	0.60	0.53	1.49	2.94	1.23
2008	2.62	0.97	1.53	2.02	0.95	1.87	0.92	0.57	1.32	2.71	1.25
2009	2.96	1.04	1.92	2.32	0.90	2.17	0.96	0.55	1.47	2.78	1.23
2010	3.15	1.14	2.11	2.28	0.76	2.28	1.13	0.59	1.44	2.72	1.26
2011	2.84	1.05	1.70	1.95	0.78	2.17	1.18	0.57	1.42	2.33	1.26
2012	3.24	1.16	2.36	2.05	0.81	2.13	1.18	0.53	1.59	2.27	1.30
2013	2.53	1.14	2.21	2.04	0.79	2.38	1.36	0.55	1.47	2.30	1.32
2014	2.68	1.03	3.78	1.67	0.51	2.16	1.34	0.55	1.48	2.18	1.28
2015	2.68	1.18	2.33	1.48	0.84	2.01	1.32	0.56	1.51	2.51	1.24
2016	2.58	1.22	2.10	1.47	1.06	2.05	1.25	0.55	1.57	2.62	1.21
2017	2.29	1.15	1.73	1.30	0.70	1.83	1.23	0.56	1.52	2.34	1.22
2018	2.26	0.98	1.66	1.19	0.60	1.95	1.24	0.60	1.67	2.24	1.23
2019	2.31	0.91	1.62	1.21	0.70	2.02	1.31	0.57	1.66	2.20	1.24
2020	2.41	0.93	1.63	1.15	0.95	1.95	1.28	0.54	1.67	2.39	1.23
2021	2.40	0.80	1.77	1.10	0.72	2.12	1.57	0.55	1.71	2.32	1.25
2022	2.22	0.74	1.20	1.07	0.12	2.13	1.64	0.48	1.71	2.07	1.26
2023	1.96	0.75	1.69	1.10	/	2.11	1.58	0.46	1.86	2.33	1.27

Source: Authors' research, based on ITC, 2024

Based on Table 2, it can be concluded that most SEE countries had a competitive agricultural sector, measured by the RCA index. Bearing in mind that this index should be greater than 1 to say that a country has a competitive agricultural sector, this can be said for the Republic of Serbia, Montenegro, North Macedonia, Bulgaria, Romania, Croatia and Greece, while Bosnia and Herzegovina in recent years did not recorded the competitiveness of this sector, as well as Albania and Slovenia, which years ago, i.e. during the entire observation period did not achieve the competitiveness of the agricultural sector. The EU as a whole had a competitive agricultural sector. Almost all SEE countries that have a competitive agricultural sector, even non- members EU, were performing better results than EU, measured by RCA index. Among WBs, Bosnia and Herzegovina and Albania did not have a competitive agricultural sector, as well as Slovenia within the EU.

The following analysis in Table 3 showed the importance of the competitiveness of the agricultural sector for economic development in SEE and EU, which is particularly important for long-term development policy, especially for countries that are largely dependent on agriculture, as is the case with the Republic of Serbia and the entire WBs.

Table 3. The importance of the agricultural sector for economic development in SEE and EU

Label	Dependent variable GDP
Intercept	-4.46E+10 (-15.84988)***
RCA	3.84E+09 (12.70388)***
trade	3.15E+08 (15.87675)***
agr_value	1.556698 (7.421350)***
Adjusted R^2	0.657354
F-statistic	119.3055***

Source: Authors' research, baesd on ITC, 2024; WDI, 2024

Note: beta coefficients in front of parentheses, t-values in parentheses, *, **, *** indicate statistical significance at the 10%, 5%, and 1% level, respectively

Table 3 showed that the competitiveness of the agricultural sector not only had a positive statistical impact on the economic development of SEE and EU, but this impact is also the biggest as measured by the beta coefficient. Also, trade, i.e. trade openness, which represents the sum of exports and imports of goods and services measured as a share of gross domestic product, had a positive impact on the economic development, as well as the value-added created by the agricultural sector. This showed the importance of increasing the value added by this sector through processing capacities and innovations, which will contribute to a greater share in trade, as well as to the long-term competitiveness of this sector, all of which had a positive impact on the economic development.

In the next part of the analysis, Table 4 compared the agricultural sector competitiveness across the observed countries. Additionally, indicators reflecting the state of the agricultural sector will be included, focusing on its productivity, yield and quality, as expressed through the prices of key agricultural products.

Table 4. Comparative analysis of agricultural sector competitiveness in SEE and EU

Country	RCA	agr_pw	yield_cereals	yield_fruit	UV_cereals	UV_fruit
Serbia	195.75	57.35	131.71	52.65	48.65	159.24
Bosnia and Herzegovina	62.42	61.24	99.35	38.71	118.06	154.88
Montenegro	148.67	179.71	22.88	115.94	137.13	82.71
North Macedonia	128.08	105.94	35.47	97.47	143.35	23.06
Albania	45.15	47.41	118.12	193.47	172.82	11.94
Bulgaria	158.81	125.59	107.12	27.24	56.82	187.71
Romania	88.67	32.53	67.12	68.94	71.59	112.41
Slovenia	11.64	139.24	174.59	117.06	73.12	95.76
Croatia	129.75	124.82	173.24	47.41	62.18	58.00
Greece	190.17	154.53	89.82	181.24	149.12	81.53
EU	95.61	185.06	146.71	135.59	92.59	156.29
Chi-Square	186.58***	180.14***	131.79***	170.98***	88.57***	163.90***

Source: Authors' research, based on ITC, 2024; FAOSTAT, 2024; WDI, 2024

Note: *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively, values expressed in Mean Rank

Table 4 showed that in terms of the competitiveness agricultural sector among the observed countries and groups, the Republic of Serbia stands out, which is far ahead of all other SEE countries, including the EU. The Republic of Serbia was followed by Greece, Bulgaria and Montenegro considering the competitiveness agricultural sector. Bosnia and Herzegovina, Albania, Romania and Slovenia were below the average of the EU agricultural competitiveness. However, in terms of the productivity of this sector, the Republic of Serbia was at the back, i.e. only Albania and Romania had worse results in terms of labour productivity in this sector. Also, all observed countries were below the EU average.

Bearing in mind the pronounced disparities of the agricultural sector of the Republic of Serbia, which was the first in terms of competitiveness, and among the last in terms of productivity, the most important agricultural products of the Republic of Serbia in terms of yield and quality, i.e. their prices, were observed. According to cereals yields, the Republic of Serbia was close to the EU average, i.e. in front of it were only Slovenia and Croatia, while according to fruit yields, it was at the back, along with Bosnia and Herzegovina, Bulgaria and Croatia. On the other hand, the quality of cereals measured by the UV index, i.e. price, was the lowest compared to all other countries, while the quality and price of fruit were above the EU average, and it had a leading position with Bulgaria. From this, we again saw large disparities between the yields and the price of the most important agricultural products of the Republic of Serbia. The Republic of Serbia exported cereals with high yields at extremely low prices, while on the other hand, fruits with very low yields exported at high prices. Concluded that this kind of competitiveness of the agricultural sector, which is based on low prices or yields, is not sustainable in the long term. Therefore, it is necessary to invest in processing capacities and innovations to raise the productivity of the agricultural sector of the Republic of Serbia and increase yields, as well as the quality, and therefore the price of important agricultural products.

Discussions

Bearing in mind that trade of agricultural products has a positive impact on trade flows (Matkovski et al., 2028), the value added of this sector should be increased by investing in processing capacities that will lead to higher product quality, and thus the price, but also by applying modern and innovative production methods that will to increase the yield of agricultural products. This is especially important for countries where agriculture plays a significant role in economic development, such as WBs. Also, in other Central and Eastern Europe (CEE) countries, lower productivity of agriculture compared to other EU countries is expressed, which is related to the level of economic development measured by GDP per capita, that is, countries with a lower level of the economic development also have lower agricultural productivity. Considering that the competitiveness of agriculture is determined precisely by the productivity of production factors, these countries also have a lower competitiveness of agriculture compared to the old EU members. That is why structural transformations of agriculture

are necessary in all observed countries (Nowak, 2016). In this context, it is necessary to produce agricultural products with higher value-added instead of big exporting quantities of agricultural raw materials with low value-added (Constantin et al., 2023). In addition to processing activities, international trade activities are equally important for the development of agricultural competitiveness (Istudor et al., 2022).

EU have a greater comparative advantage in cereals measured by the RCA index compared to WBs. Among WBs, economic development measured by GDP per capita, political stability and agriculture value added per worker positively influence RCA (Kovljenić et al., 2024). Given that in terms of labour productivity in agriculture, as well as economic development, WBs lag behind the EU, the competitiveness of these countries in agriculture cannot be sustainable. WBs should also increase the productivity of other agricultural production factors, such as soil productivity, by using bigger amounts of mineral fertilizers, while preserving the environment, but also by increasing livestock and improving technological progress in agriculture (Đokić et al., 2022).

WBs, as well as CEE countries, record low levels of partial productivity of agriculture, especially labor productivity, compared to the EU, which has a negative impact on the competitiveness of agriculture in these countries (Zekić et al., 2009, Zekić et al., 2010). Increasing agricultural productivity directly impacts production diversification, access to higher value markets, resilience to climate change, and increased competitiveness (Čekrlija et al., 2023). The productivity of agricultural inputs can contribute to greater agricultural production while preserving the environment and climate change, and thus to sustainable development (Dimitrijević et al., 2024).

In addition to the fact that the WBs lag behind developed countries in terms of development, the most noticeable is the lag behind the European average in labor productivity. Productivity and competitiveness indicators are causally linked to innovation and technological readiness (Bacovic, 2021; Bešić et al., 2024). The technological progress of WBs agriculture, which is significantly worse than the EU, represents a great potential for increasing the efficiency of WBs agriculture (Horvat et al., 2020). In addition to WBs, the new EU members compared to the old ones (EU-15) have worse productivity in agriculture (Kijek et al., 2019; Baráth & Fertő, 2017). To eliminate these disparities, a policy of cohesion and alignment with the CAP is essential. Agricultural labor productivity and green gas emissions represent major milestones in the evolution of the CAP (Constantin et al., 2021). In addition to the CAP, the WBs should align its agricultural policy with the European Green Deal, with the aim of sustainable agricultural development and climate change mitigation (Županić et al., 2021).

The productivity of the CEE largely depends on the implemented transition process, distortions, implemented reforms, as well as invested capital and new technologies (Swinnen & Vranken, 2010). The CEE achieve agricultural competitiveness mainly among crops (wheat and sunflower) and this is due to lower factor prices. Improving the agricultural competitiveness of these countries can be achieved through the improvement of product quality, technological changes, productivity and efficiency, as

well as the improvement of processing capacities and products with higher value-added (Bojnec, 2002). The candidate countries for EU membership have difficulty achieving competitiveness of the agricultural sector due to low levels of development, lack of investments in the agricultural sector, as well as access to the international market and low productivity. In addition, agriculture cannot play a significant role in Albania, Bosnia and Herzegovina and Montenegro due to climatic conditions (mountainous regions), which significantly limits agricultural production (Jankowska, 2021).

There is still a gap in the competitiveness of agriculture between the old and new EU members, given that the new members have lower productivity and a higher share of agriculture in gross value added. Therefore, these countries should focus on productive and sustainable agricultural systems, which will also affect the competitiveness of this sector (Jarosz-Angowska et al., 2022). In addition to innovations, increasing the efficiency and productivity of the agricultural sector, research and development (R&D), products with higher value-added, and accession to the EU play a significant role in improving the competitiveness of the agricultural sector (Mizik, 2021).

Taking into account that the WBs are in the process of accession to the EU, as well as their significant lag behind the EU, especially the old members, improving the productivity and efficiency of agriculture, as well as the modernization of this sector are of extreme importance for these countries (Đokić et al., 2022a). WBs, as well as new EU members, i.e. the countries of CEE, are at a similar level of technological efficiency of agriculture, whose improvement is influenced by the size of the land per worker, the fertilizer used per hectare, as well as EU membership (Đokić et al., 2020).

Despite the comparative advantage of the WBs agricultural sector, where Serbia dominates, and Albania is the only one that does not realize the comparative advantage of this sector, to reach EU standards, it is necessary to increase the quality of agricultural products. Exports are dominated by products with a low stage of processing and value-added, low quality or quantity, i.e. yields, as well as low price competitiveness. Therefore, these countries have to adapt their agriculture to increase agricultural productivity and competitiveness (Matkovski et al., 2016). Regional cooperation and the Open Balkans initiative can contribute to the achievement of these goals (Rikalović et al., 2022).

Conclusions

Given the significant lagging of the agricultural sector in terms of productivity and competitiveness, not only in the WBs but also the new EU members compared to the old ones, it is important to carry out structural transformation following the EU and to harmonize national agricultural policies with the CAP EU. Among the WBs, all countries, except Albania and Bosnia and Herzegovina in recent years, have achieved a comparative advantage in the agricultural sector. All observed EU countries, except Slovenia, also have a comparative advantage in this sector. It can be said that the first hypothesis is confirmed, given that most SEE countries, except Albania and Slovenia, have a comparative advantage in the agricultural sector.

To maintain the high competitiveness of this sector, it is necessary to increase productivity by introducing modern technologies and technological progress in agriculture, as well as by greater processing of agricultural products and production of products with greater value added. This, as well as by innovating production, can influence the increase in quality and prices, as well as the yield of important agricultural products. This will reflect on the higher value-added of agricultural products and trade of these products, which will further have a multiplied impact on improving the competitiveness of the agricultural sector, and will also positively reflect on the economic development of the observed countries, thus confirming the second hypothesis of the research.

The Republic of Serbia realizes the biggest comparative advantage of this sector, not only concerning WBs but also to other SEE countries that are the members of EU, as well as to the EU at all, thus confirming the third hypothesis of the research. However, the productivity of the agricultural sector of the Republic of Serbia is at the very bottom compared to SEE. Also, all SEE countries have a lower productivity of the agricultural sector compared to the EU. The most important agricultural export products of the Republic of Serbia are characterized by low quality and price, as in the case of cereals, or low yields, as in the case of fruit. Bearing this in mind, with the expressed low productivity of the agricultural sector, it is concluded that this competitiveness of the agricultural sector of the Republic of Serbia, which is based on low prices and yields, is not sustainable in the long term, thus confirming the fourth hypothesis of the research.

Some limitations that can be singled out, which can also be a recommendation for future research, is to include old EU members in the sample, as well as to observe and compare the comparative advantage of the most important agricultural products of all observed countries through their yields and prices that should reflect the quality of these products.

Conflict of interests

The authors declare no conflict of interest.

References

1. Bacovic, M. (2021). Productivity Growth and Its Determinants in Western Balkan Countries. In: Bayar, Y. (Ed.). *Proceedings of 12 th SCF International Conference on "Contemporary Issues in Social Sciences" (42-60).* Bandirma Onyedi University Faculty of Economics and Administrative Science.
2. Balassa, B. (1965). Trade Liberalisation and "Revealed" Comparative Advantage. *The Manchester School*, *33*(2), 99–123. doi:10.1111/j.1467-9957.1965.tb00050.x.
3. Baráth, L., & Fertő, I. (2017). Productivity and convergence in European agriculture. *Journal of Agricultural Economics*, *68*(1), 228-248. https://doi.org/10.1111/1477-9552.12157

4. Bešić, C., Bogetić, S., Bakator, M., & Petrevska, I. (2024). The impact of sustainability, digital technologies, and employee knowledge on the competitiveness of personalized tourist offer. *Hotel and Tourism Management*, *12*(1), 133-152. https://doi.org/10.5937/menhottur2400010B

5. Bojnec, S. (2002). Agricultural and food competitiveness in transition Central and Eastern European countries: social profit rate and domestic resource cost approaches. *Agricultural Economics Review*, *3*(2), 5-21. doi: 10.22004/ag.econ.26460

6. Čekrlija, S., Đuričić, Z., Jovanović, R. ., & Pešević, S. (2023). Managing the productivity process in agriculture, a framework for improving the market position of agriculture of the Republic of Srpska. *Economics of agriculture*, *70*(3), 855–865. https://doi.org/10.59267/ekoPolj2303855C

7. Constantin, M., Radulescu, I. D., Andrei, J. V., Chivu, L., Erokhin, V., & 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*(1), 53–67. https://doi.org/10.5937/ekoPolj2101053C

8. Constantin, M., Sapena, J., Apetrei, A., & Pătărlăgeanu, S. R. (2023). Deliver smart, not more! Building economically sustainable competitiveness on the ground of high agri-food trade specialization in the EU. *Foods*, *12*(2), 232. https://doi.org/10.3390/foods12020232

9. Dimitrijević, M. S., Bošković, N. ., Veselinović, P., & Leković, M. (2024). Agricultural inputs use for sustainable development: the innovative countries and the Republic of Serbia. *Economics of agriculture*, *71*(3), 853–870. https://doi.org/10.59267/ekoPolj2403853D

10. Dimitrijević, M. S., Čakajac, B. M., & Milojević, I. R. (2023a). Competitiveness of the agri-food sector of the Republic of Serbia. *Journal of Agricultural Sciences, Belgrade*, *68*(3), 347-361. https://doi.org/10.2298/JAS2303347

11. Dimitrijević, M., Ristić, L., & Bošković, N. (2022). Rural tourism as a driver of the economic and rural development in the Republic of Serbia. *Hotel and Tourism Management*, *10*(1), 79–90. https://doi.org/10.5937/menhottur2201079D

12. Dimitrijević, M., Ristić, L., & Despotović, D. (2023b). Agri-food products quality as exports competitiveness determinant of the Republic of Serbia. *Facta Universitatis, Series: Economics and Organization, 20*(2), 117-133. https://doi.org/10.22190/FUEO230412008D

13. Dimitrijević, M., Veselinović, P., & Ristić, L. (2023). State and perspectives of agriculture development in the Western Balkan countries. *International Review*, *(1-2),* 90-98. doi: 10.5937/intrev2302096D

14. Đokić, D., Matkovski, B., Jeremić, M., & Đurić, I. (2022). Land productivity and agri-environmental indicators: A case study of Western Balkans. *Land*, *11*(12), 2216. https://doi.org/10.3390/land11122216

15. Đokić, D., Novaković, T., Tekić, D., Matkovski, B., Zekić, S., & Milić, D. (2022a). Technical efficiency of agriculture in the European Union and Western Balkans: SFA method. *Agriculture*, *12*(12), 1992. https://doi.org/10.3390/agriculture12121992

16. Đokić, D., Zekić, S., Jurjević, Ž., & Matkovski, B. (2020). Drivers of technical efficiency in agriculture in the Western Balkans and New EU Member States. *Custos Agronegocio Online*, *16*, 2-15.

17. Erjavec, E., Volk, T., Rednak, M., Ciaian, P., & Lazdinis, M. (2021). Agricultural policies and European Union accession processes in the Western Balkans: aspirations versus reality. *Eurasian Geography and Economics, 62*(1), 46-75. https://doi.org/10.1080/15387216.2020.1756886

18. FAOSTAT (2024). *Data*. Retrieved from https://www.fao.org/faostat/en/#data (November 11, 2024)

19. Fischer, C. (2010). Food Quality and Product Export Performance: An Empirical Investigation of the EU Situation. *Journal of International Food & Agribusiness Marketing*, *22*(3-4), 210–233. doi:10.1080/08974431003641265

20. Horvat, A., Matkovski, B., Zekić, S., & Radovanov, B. (2020). Technical efficiency of agriculture in Western Balkan countries undergoing the process of EU integration. *Agricultural Economics/Zemědělská Ekonomika*, *66*(2), 65-73. doi: 10.17221/224/2019-AGRICECON

21. Istudor, N., Constantin, M., Ignat, R., Chiripuci, B. C., & Petrescu, I. E. (2022). The Complexity of Agricultural Competitiveness: Going Beyond the Balassa Index. *Journal of Competitiveness, 14*(4), 61–77. https://doi.org/10.7441/joc.2022.04.04

22. ITC (2024). *Trade Map*. Retrieved from https://www.trademap.org/Index.aspx (November 11, 2024)

23. Jankowska, A. (2021). Agricultural trade competitiveness of EU candidate countries and eastern partnership countries. *European Research Studies Journal*, *24*(1), 316-334.

24. Jarosz-Angowska, A., Nowak, A., Kołodziej, E., & Klikocka, H. (2022). Effect of European Integration on the Competitiveness of the Agricultural Sector in New Member States (EU-13) on the Internal EU Market. *Sustainability*, *14*(20), 13124. https://doi.org/10.3390/su142013124

25. Kijek, A., Kijek, T., Nowak, A., & Skrzypek, A. (2019). Productivity and its convergence in agriculture in new and old European Union member states. *Agricultural Economics/Zemědělská Ekonomika*, *65*(1), 01-09. https://doi.org/10.17221/262/2017-AGRICECON

26. Kovljenić, M., Matkovski, B., & Đokić, D. (2024). Competitiveness and Cereal Self-Sufficiency in Western Balkan Countries. *Agriculture*, *14*(9), 1480. https://doi.org/10.3390/agriculture14091480

27. Matkovski, B., Djokic, D., & Zekic, S. (2016). Export performances of the agricultural sector of the Western Balkan countries. In: Tomić, D., Lovre, K., Subić, J., Ševarlić, M. (Eds.). *Emerging technologies and the development of agriculture (pp. 294-303).* Novi Sad, Serbian Association of Agricultural Economists, Faculty of Economics in Subotica, University of Novi Sad, Institute of Agricultural Economics.

28. Matkovski, B., Kalaš, B., Zekić, S., & Jeremić, M. (2019). Agri-food competitiveness in South East Europe. *Outlook on Agriculture*, *48*(4), 326-335. https://doi.org/10.1177/00307270198547

29. Matkovski, B., Zekić, S., Đokić, D., Jurjević, Ž., & Đurić, I. (2021). Export competitiveness of agri-food sector during the EU integration process: Evidence from the Western Balkans. *Foods*, *11*(1), 10. https://doi.org/10.3390/foods11010010

30. Matkovski, B., Zekic, S., Savic, M., & Radovanov, B. (2018). Trade of agri-food products in the EU enlargement process: Evidence from the Southeastern Europe. *Agricultural Economics/Zemedelska Ekonomika*, *64*(8). 357–366.

31. Mizik, T. (2021). Agri-food trade competitiveness: A review of the literature. *Sustainability*, *13*(20), 11235. https://doi.org/10.3390/su132011235

32. Nowak, A. (2016). The competitiveness of agriculture of EU member countries of Central and Eastern Europe. *Acta Scientiarum Polonorum. Oeconomia*, *15*(2), 113-125.

33. Nowak, A., & Różańska-Boczula, M. (2021). The competitiveness of agriculture in EU member states according to the competitiveness pyramid model. *Agriculture*, *12*(1), 28. https://doi.org/10.3390/agriculture12010028

34. Pantović, D., Bošković, N., & Petrović, T. (2022). Measuring Convergence in Tourism Competitiveness of Natural and Cultural Resources: A Case of the Balkans and Eastern Europe. *Ekonomický časopis*, 910 (70/2022), 703 – 722. Doi: https://doi.org/10.31577/ekoncas.2022.09-10.02

35. Rikalović, G. M., Molnar, D. S., & Josipović, S. N. (2022). The Open Balkan as a development determinant of the Western Balkan countries. *Acta Economica*, 20(36), 31-51. https://doi.org/10.7251/ACE2236031R

36. Simonović, Z., Miletić, S., & Popović, V. (2019). Some features of development in the agricultural policy Western Balkan candidates for market access in the EU. *Economics of agriculture*, *66*(2), 541–557. https://doi.org/10.5937/ekoPolj1902541S

37. Swinnen, J. F., & Vranken, L. (2010). Reforms and agricultural productivity in Central and Eastern Europe and the Former Soviet Republics: 1989–2005. *Journal of Productivity Analysis*, *33*, 241-258. https://doi.org/10.1007/s11123-009-0162-6

38. Volk, T., Rednak, M., & Erjavec, E. (2012). Western Balkans agriculture and European integration: unused potential and policy failures?. *Post-Communist Economies*, *24*(1), 111-123. https://doi.org/10.1080/14631377.2012.647631

39. WDI - World Development Indicators (2024). *Data Bank*. Retrieved from https://databank.worldbank.org/source/world-development-indicators (November 11, 2024)

40. Zekić, S., Gajić, M., & Lovre, K. (2010). Partial productivity of agriculture in the Western Balkan countries – implication for competitiveness of the rural economy. *Economics of agriculture*, *57*(Special number 1), 21-35.

41. Zekić, S., Lovre, K., & Gajić, M. (2009). Agricultural transformation of the Western Balkan′s countries in the transitional period. *Economics of agriculture*, *56*(2), 187–200.

42. Županić, F. Ž., Radić, D., & Podbregar, I. (2021). Climate change and agriculture management: Western Balkan region analysis. *Energy, Sustainability and Society*, *11*(1), 51. https://doi.org/10.1186/s13705-021-00327-z

THE IMPACT OF MACROECONOMIC UNCERTAINTY AND OIL PRICES ON FOOD PRICES: EMPIRICAL EVIDENCE FROM SERBIA

Zorica Mladenović[1], Emilija Milošević[2]

**Corresponding author E-mail: zorica.mladenovic@ekof.bg.ac.rs*

ARTICLE INFO

Original Article

Received: *01 February 2025*

Accepted: *25 February 2025*

doi:10.59267/ekoPolj2501271M

UDC 338.516:[622.323:641/642(497.11)

Keywords:

food prices, macroeconomic uncertainty, oil prices, cointegration analysis, SVAR model

***JEL**: Q11, Q41, E31*

ABSTRACT

The purpose of the paper is to investigate the impact of crude oil prices and domestic macroeconomic uncertainty on food prices in Serbia over the period 2007-2022. The methodological framework is based on cointegration analysis and the structural vector autoregressive model. The empirical results indicate significant and positive long-term effects of uncertainty and oil prices on food prices. Over a one-year horizon, about one-third of the fluctuations in food prices can be attributed to the variability of shocks in uncertainty and oil prices, while their relative influence is slightly more than half after two years. The impact of uncertainty on food price variability peaks within six months, after which its influence diminishes. In contrast, the impact of oil prices gradually increases and becomes the dominant factor in the variability of food prices after a year and a half.

Introduction

In recent years, several events have caused significant changes in oil and food prices. At the beginning of 2020, the COVID-19 pandemic led to a large drop in global energy commodity prices. One of the main reasons of this negative impact is the drop-in demand for energy due to the slowdown in economic activity during the first wave of the pandemic. In 2021, there was a significant increase in energy prices as a result of both demand-side and supply-side factors. Russia's invasion of Ukraine in early 2022 caused increased uncertainty around energy supplies and drove energy prices even higher. A sharp rise in energy costs was the primary driver behind the surge in consumer food inflation during 2021 and 2022 (ECB Economic Bulletin, Issue 2/2024).

1 Zorica Mladenović, Full professor, Faculty of Economics and Business, University of Belgrade, Kamenička 6, 11000 Belgrade, Serbia, Phone number: +381638080760, E-mail: zorica.mladenovic@ekof.bg.ac.rs, ORCID ID (https://orcid.org/0000-0003-1579-4205)

2 Emilija Milošević, Teaching assistant, Faculty of Economics and Business, University of Belgrade, Kamenička 6, 11000 Belgrade, Serbia, Phone number: +381604047024, E-mail: emilija.milosevic@ekof.bg.ac.rs, ORCID ID (https://orcid.org/0000-0001-8980-3608)

Analyzing fluctuations in food prices and their key drivers is crucial for every country, both economically and socially. The economic aspects of these changes are reflected in their impact on the agriculture sector, inflation, purchasing power, and overall economic stability. For consumers, particularly in low-income countries, food accounts for a substantial share of household spending. Sharp increases in food prices can jeopardize food security, while also widening social inequality and deepening poverty (De Hoyos & Medvedev, 2011).

Numerous studies have explored the influence of oil prices on food prices (Serra et al., 2011; Nazlioglu et al., 2013; Nazlioglu & Soytas, 2011; Baumeister & Kilian, 2014; Fowowe, 2016; Zmami & Ben-Salha, 2019; Chen et al., 2020). The direct and indirect transmission mechanisms have been identified (Fowowe, 2016). An increase in oil prices influences agricultural commodity prices directly by rising both transportation costs and the costs of vital agricultural inputs. Additionally, some agricultural commodities are used for renewable fuel production like ethanol and biodiesel. The rise in oil prices may increase demand for these agricultural commodities due to the increasing use of biofuel as an alternative energy source. The indirect channel works through the exchange rate, where higher oil prices lead to a larger current account deficit, resulting in a depreciation of the local currency.

While there is extensive research on the link between oil prices and food prices, the impact of uncertainty has received less attention. One of the challenges in empirical research is measuring uncertainty. Since pioneering paper Bloom (2009), many studies have focused on constructing measure to capture its level (Bachmann et al., 2013; Jurado et al., 2015; Rossi & Sekhposyan, 2015; Baker et al., 2016). The Real Option Theory shows that levels of investment and consumption are reduced due to uncertainty (Bloom, 2014). The changes in investment in agricultural products have a direct impact on their supply, and consequently, their prices. However, it is more challenging to delay purchases of nondurables like food, so the impact of uncertainty on nondurable consumption through the real option channel will be lower (Bloom, 2014). Frimpong et al. (2021) point out that global economic policy uncertainty can affect commodity price fluctuations through domestic agricultural policy adjustments. Since not all countries are major producers of every commodity, global economic uncertainty affects terms of trade, resulting in commodity price co-movements as countries adjust their production and trade strategies. The impact of economic policy uncertainty on food prices has been investigated by several empirical studies (Frimpong et al.,2021; Wen et al.,2021; Long et al., 2023; Chen et al.,2024), using news-based index developed in Baker et al. (2016).

The purpose of this paper is to investigate the impact of crude oil prices and domestic macroeconomic uncertainty on food prices in Serbia. Monthly data are employed covering the period from December 2007 to December 2022. In Serbia, food and non-alcoholic beverages represent the largest category of individual household spending. Specifically, this category accounts for 36% of total consumption expenditure.[3] Given the high share of food expenditures, any significant rise in food prices could threaten

3 Household budget Survey, 2022, Statistical Office of the Republic of Serbia.

price stability and overall inflation level. After a long period of stable inflation in Serbia, inflation began to rise in mid-2021, reaching a 15.1% by the end of 2022. Around two-thirds of y-o-y inflation, measured in December 2022, originated from food and energy prices.[4] Serbia pursues the inflation targeting as a framework for monetary policy. The strong influence of food prices on inflation makes the implementation of monetary policy more challenging. The volatility of food prices disrupts inflation forecasts, can lead to distorted inflation expectations and undermines public confidence in the central bank, which is crucial for effective inflation targeting (Šoškić, 2015).

The following research questions are considered: Is there a long-run relationship between crude oil prices, macroeconomic uncertainty and food prices in Serbia? What are the dynamic impacts of domestic macroeconomic uncertainty and crude oil price shocks on food price fluctuations in Serbia? These questions are addressed in the context of cointegration analysis and the structural vector autoregressive model. The empirical results indicate significant and positive long-term effects of uncertainty and oil prices on food prices. Over a time horizon of one year, about one third of the fluctuations in food prices can be attributed to the variability of shocks in uncertainty and oil prices. The importance of these shocks increases with the time horizon, so that their relative influence is slightly more than half after two years.

This paper contributes to the existing literature in three ways. First, the existing studies have not examined the impact of macroeconomic uncertainty and crude oil prices on food prices in Serbia. The empirical findings from this study could be of interest to various economic agents. For instance, policymakers in Serbia can use this information to develop sustainable agricultural and trade policies aimed at reducing the economic and social effects of food price fluctuations. Second, previously conducted research about uncertainty and food prices mainly use EPU index (Baker et al., 2016) in the empirical analysis. Ozturk & Sheng (2018) point out that this uncertainty measure provides a high standard for the attention of reporters and editors, who may overlook uncertainty events if they do not cover the topic in their reporting. This study employs the econometric approach proposed by Jurado et al. (2015), that incorporates a wide range of macroeconomic indicators. Thirdly, two different econometric methods are used to improve the robustness of the results. Cointegration analysis aims to uncover the long-run determinants of food prices and to model the adjustment of food prices to the long-run equilibrium relationship. The structural vector autoregressive model provides a framework for assessing the dynamic response of food prices to shocks in uncertainty and oil prices after identifying structural short-run restrictions.

Literature review

The connection between oil and food prices has been explored in a large number of studies. Empirical results are inconclusive. On the one hand, numerous studies offer evidence that crude oil frequently acts as an exogenous factor, transmitting volatility

4 Inflation report, February 2023, National Bank of Serbia.

from the oil prices to food prices (Ciaian, 2011; Serra et al., 2011; Nazlioglu et al., 2013). On the other hand, various studies present different results indicating either no spillover from crude oil to food prices (Nazlioglu & Soytas, 2011; Baumeister & Kilian, 2014; Fowowe, 2016) or a bidirectional influence between them (Tiwari et al. 2018; Adeosun et al., 2023).

Ciaian (2011) examined the relationship between the energy, bioenergy and global prices for nine agricultural commodities. The analysis was carried out on weekly data from January 1993 to December 2010. To account for structural breaks, sample were divided into three equal periods: 1993-1998, 1999-2004, and 2005-2010. Cointegration between agricultural commodity and oil prices was observed only in the third period. Granger causality test revealed that changes in oil prices lead to changes in agricultural commodity prices, but not the other way around. Similar results were found in Nazlioglu et al. (2013). Serra et al. (2011) examined the transmission patterns between ethanol, corn, oil, and gasoline prices in the United States from January 1990 to December 2008. The results from smooth transition vector error correction model showed that energy price surges cause corn prices to rise.

In contrast, the empirical findings from some studies indicate that food prices are not influenced by fluctuations in oil prices. Nazlioglu & Soytas (2011) analyzed the interrelationship between global oil prices, the lira–dollar exchange rate, and the prices of five individual agricultural commodities in Turkey for the period: January 1994-March 2010. The long-run causality analysis showed that agricultural commodity prices were unaffected by changes in oil prices. Similar findings were obtained for South Africa (Fowowe, 2016). Baumeister & Kilian (2014) employed VAR models to examine the transmission of oil price shocks to food prices before and after shift in U.S. biofuel policy in May 2006. Data were divided into two parts: 1974:M01-2006:M04 and 2006M05:2013M05. The results indicated no connection between food and oil prices during any of the observed periods.

Common factors, including economic conditions, advancements in technology, and market trends, may lead to fluctuations in both food and oil prices. Due to their interconnectedness, changes in food prices could potentially serve as an indicator for future changes in oil prices (Adeosun et al., 2023). Tiwari et al. (2018) applied the continuous wavelet (CWT) to examine the time-frequency relationship between the oil price index and 21 international price indices of agricultural commodities for the period: January 1980 - May 2017. The results indicated a significant long-term association between variables considered. Adeosun et al. (2023) examined causal links in globally traded oil and eight international price indices from January 1990 to February 2021 using bootstrapped time-varying Granger causality method. The findings revealed that oil prices and six food commodity prices influence one another, and that wheat and soybean prices have a causal effect on oil prices.

Several empirical studies have examined the effect of uncertainty on food prices. Most of them focused on economic policy uncertainty (EPU), using the news-based indicator

developed in Baker et al. (2016). Wen et al. (2021) investigated the symmetric and asymmetric impacts of EPU index on food prices in China based on monthly sample January 1998 - May 2020. The application of ARDL models suggested that higher food prices are driven by an increase in uncertainty over both the short and long term, while results from NARDL models indicated only short-term effect. Frimpong et al. (2021) investigated the effect of global EPU index on the co-movement of five major agricultural commodities using monthly data from January 1997 to December 2019. The wavelet analysis showed that removing the effect of uncertainty significantly reduced the coherence among agricultural commodities.

Long et al. (2023) used NARDL models to investigate the asymmetric impact of global EPU on international grain prices from January 1998 to May 2021. The results showed that EPU positively correlates with international grain prices, causing prices to rise with policy uncertainty increases and fall with its decreases. Chen et al. (2024) analyzed the effect of oil prices and global EPU on domestic food prices in 41 developing countries from January 2000 to March 2023. The cointegration analysis revealed a long-run relationship between uncertainty, oil and food prices in developing countries.

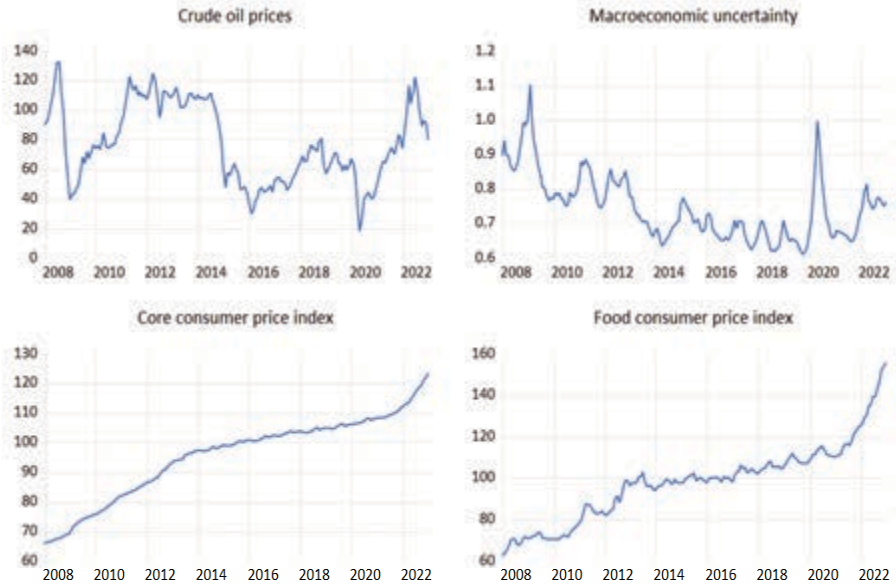
The effect of macroeconomic uncertainty on food prices has been the focus of only a few studies. Joëts et al. (2017) analyzed the impact of macroeconomic uncertainty on international commodity markets (energy, precious metals, agriculture, and industry) using a measure of macroeconomic uncertainty developed in Jurado et al. (2015). For agricultural markets, the analysis spanned from February 1980 to December 2011. The results from structural threshold VAR model showed that changes in the variability and level of macroeconomic uncertainty have a strong effect on the agricultural markets. Ben et al. (2021) estimated individual commodity price uncertainty for eight main categories of commodity markets for the period January 1960 - June 2020. The estimation of commodity price uncertainty was based on the approach of Jurado et al. (2015). The time-varying VAR models were applied to analyze the dynamic connectedness between commodity uncertainties and Jurado et al. (2015) macroeconomic uncertainty index. The findings indicated that commodity price uncertainty is significantly impacted by macroeconomic uncertainty.

Data description

The dataset for this analysis consists of food consumer price index in Serbia (FCPI), core consumer price index in Serbia (CCPI), indicator of macroeconomic uncertainty in Serbia (MU) and the crude oil prices (OILP). Core prices are based on consumer price index after excluding energy, food, alcohol and tobacco. Monthly observations from December 2007 to December 2022 are used. The data of food and core price indices are taken from Eurostat. The one-month ahead macroeconomic uncertainty measure based on econometric approach proposed by Jurado et al. (2015) is derived. The data of crude oil prices (Brent – Europe, dollars per barrel) are taken from FRED, Federal Reserve Bank of St. Louis. In the analysis, logarithm values of variables are used, and the food and core consumer price indices are seasonally adjusted using Census X-12 method.

The data on crude oil prices, the macroeconomic uncertainty indicator and the core and food price indices are shown in Figure 1. Oil prices do not appear to be stationary, with two sub-periods characterized by different price levels. From 2008 to 2014, crude oil prices were relatively high, with two sharp declines occurring in 2008 and 2014. The sharp decline in 2008 was triggered by the global financial crises, while the price drop in 2014 was due to an increasing oversupply of oil. In contrast, oil prices were significantly lower from 2015 to 2021. At the beginning of 2020, the COVID-19 pandemic caused a strong drop in oil prices. The years 2021–2022 saw a strong rebound, driven by the economic recovery and supply constraints, which are exacerbated by Russia's invasion of Ukraine. The indicator for macroeconomic uncertainty is characterized by stationary fluctuations, albeit with two significant spikes caused by the global financial crises in 2008 and the COVID-19 pandemic in 2020. Core and food consumer price indices show a strong upward trend, which is described by the presence of the unit root (stochastic trend). In addition, the price index for food has been rising significantly since mid-2021.

Figure 1. Crude oil prices, macroeconomic uncertainty, core and food consumer price indices



Source: Eurostat, FRED and author's calculations

Methodology review

Empirical methodology comprises three important steps. First, the stationarity of the time series is examined using several unit root tests. Second, the existence of the long-run relationship between the variables under consideration is examined within the autoregressive distributed lag (ARDL) model and bounds testing approach (Pesaran, Shin & Smith, 2001). Third, the short-term dynamic structure between the variables

is derived from the impulse response analysis and the decomposition of the forecast error variances estimated from the SVAR. The ARDL modelling approach and SVAR modelling will be briefly discussed.

ARDL modelling

The ARDL model of order (p,q) is defined as follows (Cho, Greenwood-Nimmo & Shin, 2023):

$$y_t = \gamma_0 + \sum_{j=1}^{p} \phi_j y_{t-j} + \sum_{j=0}^{q} \boldsymbol{\theta}_j' \boldsymbol{x}_{t-j} + error \quad (1)$$

where y_t denotes the variable to be modelled (in this study food consumer price index) and $\boldsymbol{x}_t'$ refers to the vector of explanatory variables (in this study it contains the core consumer price index, macroeconomic uncertainty and crude oil prices).

Model (1) is often stated in the following form:

$$y_t = \gamma_0 + \boldsymbol{x}_t' \boldsymbol{\gamma} + \sum_{j=1}^{p} \phi_j y_{t-j} + \sum_{j=0}^{q-1} \Delta \boldsymbol{x}_{t-j}' \boldsymbol{\delta}_j + error \quad (2)$$

where $\boldsymbol{\gamma} = \sum_{j=0}^{q} \boldsymbol{\theta}_j$ and $\boldsymbol{\delta}_j = -\sum_{i=j+1}^{q} \boldsymbol{\theta}_i$.

The specification of the ARDL model enables the following unconditional error-correction model (Cho, Greenwood-Nimmo & Shin, 2023):

$$\Delta y_t = \gamma_0 + \rho y_{t-1} + \boldsymbol{\theta}' \boldsymbol{x}_{t-1} + \sum_{j=1}^{p-1} \eta_j \Delta y_{t-j} + \sum_{j=0}^{q-1} \boldsymbol{\kappa}_j' \Delta \boldsymbol{x}_{t-j} + error \quad (3)$$

under the following restrictions:

$\rho = \sum_{j=1}^{p} \phi_j - 1$, $\boldsymbol{\theta} = \sum_{j=0}^{q} \boldsymbol{\theta}_j$, $\boldsymbol{\kappa}_0 = \boldsymbol{\theta}_0$, $\eta_l = -\sum_{i=l+1}^{p} \phi_i$, $\boldsymbol{\kappa}_j = -\sum_{i=j+1}^{q} \boldsymbol{\theta}_i$, and $l = 1,2,\ldots,p-1$, $j = 1,2,\ldots,q-1$.

If cointegration is present, so that the linear combination $u_t = y_t - \boldsymbol{\beta}' \boldsymbol{x}_t$ is stationary, then (3) takes the following form of the conditional error-correction model:

$$\Delta y_t = \gamma_0 + \rho u_{t-1} + \sum_{j=1}^{p-1} \eta_j \Delta y_{t-j} + \sum_{j=0}^{q-1} \boldsymbol{\kappa}_j' \Delta \boldsymbol{x}_{t-j} + error \quad (4)$$

Vector of cointegration parameters $\boldsymbol{\beta}$ is equal to $-\boldsymbol{\theta}/\rho$. The corresponding cointegration estimators are derived from applying the OLS method to equations 1-3. Estimators of cointegration parameters are super-consistent with asymptotically normal mixed distribution, whereas estimators of short-run parameters are consistent and asymptotically normally distributed (Pesaran, Shin & Smith, 2001).

The test for the existence of a long-run relationship (cointegration) is based on the bounds testing approach of Pesaran, Shin & Smith. The null hypothesis that there is no long-run relationship, $\rho = 0$ and $\boldsymbol{\theta}' = \boldsymbol{0}$, is tested using the formula of the F-statistic derived from equation (3). However, this statistic does not have a standard F- distribution.

The test approach allows various assumptions regarding the order of integration of the time series. The test can be conducted regardless of whether the time series are stationary, unit root processes or a combination of both. The test also includes various combinations of deterministic components (constant and trend).

The ARDL model has been used extensively in empirical literature. It has several modifications that are also frequently applied. For example, the non-linear ARDL model accounts for the possibility that positive and negative components in the subset of explanatory variables (e.g. oil prices) may have different long-run and short-run effects on the dependent variable (Shin, Yu & Greenwood-Nimmo, 2014).

SVAR modelling

Standard vector autoregressive (VAR) model of order *k* for the vector time series $\boldsymbol{X}_t$ (*mx1*) is defined as follows:

$$\boldsymbol{X}_t = \Phi_1 \boldsymbol{X}_{t-1} + \Phi_2 \boldsymbol{X}_{t-2} + \cdots + \Phi_k \boldsymbol{X}_{t-k} + \boldsymbol{\varepsilon}_t \quad (5)$$

$\Phi_1, \Phi_2, \ldots, \Phi_k$ are parameter matrices (*mxm*). The error component $\boldsymbol{\varepsilon}_t$ (*mx1*) contains zero mean individually uncorrelated time series with finite variance. It has multivariate normal distribution with the covariance matrix denoted by $\boldsymbol{\Sigma}$. In this study $\boldsymbol{X}_t$ contain the four variables introduced above.

In order to enable a structural interpretation within the framework of VAR models, additional identifying restrictions are often introduced for the model parameters. This leads to a structural VAR model (SVAR), which is suitable for several econometric investigations. Two of the most important of these are: 1. Impulse response function analysis and 2. Forecast error variance decomposition. The impulse response function analysis allows the estimation of the expected responses of the model variables to a one-time unexpected random shock. The forecast error variance decomposition measures the contribution of the variability of the unexpected random shock to the total variability of the model variables.

The SVAR model with short-run restrictions reads as follows:

$$\Lambda_0 \boldsymbol{X}_t = \Lambda_1 \boldsymbol{X}_{t-1} + \Lambda_2 \boldsymbol{X}_{t-2} + \cdots + \Lambda_k \boldsymbol{X}_{t-k} + \boldsymbol{u}_t \quad (6)$$

$\Lambda_0, \Lambda_1, \Lambda_2, \ldots, \Lambda_k$ are parameter matrices (*mxm*). Structural relations are introduced through the matrix Λ_0. The covariance matrix of vector error component $\boldsymbol{u}_t$ (*mx1*), $\boldsymbol{\Sigma}_u$ is a unit matrix: $E(\boldsymbol{u}_t \boldsymbol{u}_t') = \boldsymbol{\Sigma}_u = I_m$. The individual error components of $\boldsymbol{u}_t$ are referred to as structural shocks or structural innovations. They have zero mean and they are individually serially uncorrelated. Structural shocks are also mutually uncorrelated with individual variance equals to 1.

Given that equation (6) is in structural form, it needs to be transformed into its reduced form representation. Under reduced form $\boldsymbol{X}_t$ should only be a function of $\boldsymbol{X}_{t-1}, \boldsymbol{X}_{t-2}, \ldots, \boldsymbol{X}_{t-k}$. This can be achieved by pre-multiplying both sides of equation (6) by Λ_0^{-1}:

$$\boldsymbol{X}_t = \Lambda_0^{-1}\Lambda_1\boldsymbol{X}_{t-1} + \Lambda_0^{-1}\Lambda_2\boldsymbol{X}_{t-2} + \cdots + \Lambda_0^{-1}\Lambda_k\boldsymbol{X}_{t-k} + \Lambda_0^{-1}\boldsymbol{u}_t \qquad (7)$$

which turns out to be standard VAR model in form (5) with following assumptions: $\Lambda_0^{-1}\Lambda_i = \boldsymbol{\Phi}_i, i = 1, \ldots, k$, and $\boldsymbol{\varepsilon}_t = \Lambda_0^{-1}\boldsymbol{u}_t$.

The relation $\boldsymbol{\varepsilon}_t = \Lambda_0^{-1}\boldsymbol{u}_t$ is essential. It indicates out that the error-components in $\boldsymbol{\varepsilon}_t$ of the VAR model (5) are a function of the structural shocks in $\boldsymbol{u}$. Stated differently, as $\boldsymbol{u}_t = \Lambda_0\boldsymbol{\varepsilon}_t$, this suggests that structural shocks can be derived from shocks in reduced form, but via Λ_0, which captures structural relationships. To estimate elements of Λ_0 (or Λ_0^{-1}), one must start from the reduced-form model, which provides information about covariance matrix (Kilian, 2013):

$$\boldsymbol{\Sigma} = E\left(\boldsymbol{\varepsilon}_t\boldsymbol{\varepsilon}_t'\right) = \Lambda_0^{-1}E\left(\boldsymbol{u}_t\boldsymbol{u}_t'\right)\Lambda_0^{-1\prime} = \Lambda_0^{-1}\boldsymbol{\Sigma}_u\Lambda_0^{-1\prime}$$

$$\boldsymbol{\Sigma} = \Lambda_0^{-1}\Lambda_0^{-1\prime} \qquad (8)$$

Equation (8) associates the covariance matrix in the standard VAR model ($\boldsymbol{\Sigma}$) with parameters that design structural relations (Λ_0^{-1}). Elements of $\boldsymbol{\Sigma}$ can be estimated consistently and therefore taken as given. The question is how to determine and identify unknown parameters of Λ_0^{-1}. Normally, certain zero restrictions are imposed on some parameters of Λ_0^{-1}.

The covariance matrix $\boldsymbol{\Sigma}$ contains *m(m+1)/2* free parameters (as being symmetric matrix). This is therefore the maximum number of parameters in Λ_0^{-1} that can be uniquely identified. There is a number of different ways how identification can be achieved (Killian & Lutkepohl, 2017).

In an alternative representation of the SVAR restrictions (8) the diagonal elements of $\boldsymbol{\Sigma}_u$ are unrestricted, while the diagonal elements of Λ_0 are set to one. Both Λ_0 and Λ_0^{-1} are lower triangular. In this representation the variances of structural shocks are different from unity. This form will be used for reporting empirical results.

Empirical results

Unit root tests

Our empirical work begins with a unit root test. The model with constant and trend is employed for the food and core price indices, while the model with only a constant is used for their first differences. The models for the macroeconomic uncertainty indicator and crude oil prices contain only a constant as a deterministic component. The results of several unit root tests are shown in Table 1. All tests indicate that food, core and oil prices are integrated of order 1. The results of the ADF and ERS tests show that the indicator for macroeconomic uncertainty is a stationary variable.

Table 1. Results of unit root tests

Variable	Test for unit root in	ADF	Number of lags	Unit root	KPSS	Unit root	ERS	Unit root
FCPI	Level	-0.98	1	Yes	0.21	Yes	-1.14	Yes
	First difference	-9.97*	0	No	0.17*	No	-7.72*	No
CCPI	Level	-2.51	3	Yes	0.39	Yes	-1.40	Yes
	First difference	-2.58***	2	No	0.52*	No	-2.36**	No
MU	Level	-3.72*	1	No	0.98	Yes	-2.04**	No
	First difference	-	-	-	0.09***	No	-	-
OILP	Level	-2.62	2	Yes	1.21	Yes	-2.31	Yes
	First difference	-9.11*	1	No	0.05***	No	-9.1*	No
Note: The test-statistic values below the critical values for the 1%, 5%, and 10% significance levels are marked with *, ** and ***. The number of lags indicates how many correction elements are incorporated in the ADF and ERS tests. In the KPSS test, truncation parameter matches the number of corrections in the ADF test, or it is equal to 10.								

Source: Author's calculations

Cointegration analysis

In this study, cointegration analysis examines the existence of a long-run equilibrium relationship between food prices, core prices, uncertainty and oil prices. To achieve main objective of assessing the long-run importance of uncertainty and oil prices for food prices, this analysis also includes core prices, which control for the influence of general market conditions on food prices.

This existence is tested with the autoregressive distributed lag (ARDL) model, as this approach can be applied when the variables are a combination of stationary and unit root processes, which is the case for this sample.

The trend component is included as a deterministic part of the cointegration space. In many empirical analyses, such a trend accounts for the long-run effects of variables that are not explicitly included in the cointegration modelling. The number of lags in the

ARDL model is chosen according to the minimum value of the Schwarz information criterion starting with a maximum of twelve lags. The statistical properties of the models are evaluated by performing autocorrelation and normality tests.

The calculated value of the bound-F test is 5.07, while the corresponding set of critical values at the 5% significance level contains the following values: 3.38 for I(0) and 4.23 for I(1). Since 5.07 is larger than 4.23, the existence of a long-run relationship between food prices, core prices, uncertainty and oil prices is confirmed. The estimated long-run elasticities are shown in Table 2 and indicate that the combination denoted by COIN is stationary: COIN= FCPI-0.77*CCPI-0.36*MU-0.10*OILP-0.002*t. All estimated long-run elasticities are positive and significant. A 1% increase in uncertainty leads to an increase in food prices by 0.36%, while a 1% increase in oil prices yields an increase in food prices by 0.10%. These figures show that food prices react relatively strongly to changes in both uncertainty and oil prices.

The estimated equilibrium error correction model is shown in Table 3. The estimated adjustment coefficient, -0.096, is highly significant. Thus, each month about 10% of food inflation is corrected towards the estimated long-run relationship with core prices, uncertainty and oil prices. The short-term dynamics of food inflation are captured by its own lagged value (with an estimate of 0.22) and by current core inflation (with an estimate of 0.62).

Table 2. Estimated long-run elasticities normalized on food prices

FCPI	CCPI	MU	OILP	Trend
1	0.77 (0.00)	0.36 (0.00)	0.10 (0.00)	0.002 (0.00)
Note: p-values are reported in parentheses below cointegration estimates.				

Source: Author's calculations

Table 3. Estimated ECM for food inflation ($\Delta FCPI_t$)

Variable	**Estimate**	***p*-value**
$COIN_{t-1}$	**-0.096**	0.00
$\Delta FCPI_{t-1}$	0.223	0.00
$\Delta CCPI_t$	0.616	0.01
Constant	0.051	0.00
Diagnostic statistics		
R^2=0.45, SC=-6.2395, Q(6)=4.39(0.62), Q(12)=15.70(0.21), Q(24)=22.05(0.58), Q^2(6)=8.41(0.21), Q^2(12)=15.20(0.23), JB=0.21(0.90)		
Note: Model contains four impulse dummy variables that take non-zero values 1 for the following months: March, 2011; May, 2012; September, 2012, and October, 2022.		

Source: Author's calculations

The asymmetric response of food prices is then tested with respect to positive and negative changes in both uncertainty and oil prices. However, this type of non-linearity could not be confirmed as the corresponding values of the F-statistics were found to be non-significant (2.02 with a p-value of 0.15 for uncertainty and 0.48 with a p-value of 0.49 for oil prices).

An alternative version of cointegration model is estimated, which assumes that food prices are expressed as a deviation from core prices: FCPI-CCPI. It was then tested whether this deviation is associated with uncertainty and oil prices in the long run. Such a modification is indeed justified by previous cointegration estimate, which provides a relatively high estimate for the CCPI of 0.77. The calculated value of the F-test for the bound test is now 5.77, above the critical 5% values of 3.88 and 4.61. Therefore, the presence of a long-term relationship is confirmed.

The estimated cointegrated relation is given as follows: COIN1= (FCPI-CCPI)-0.38*MU-0.09*OILP-0.0016*t. Long-run elasticities of uncertainty and oil prices remained practically unchanged. This finding suggests that the stochastic trend in the difference between food prices and core prices is due to movements in uncertainty and oil prices. A new ECM based on COIN1 is reported in Table 4.

Table 4. Estimated ECM for difference between food and core inflation ($\Delta FCPI_t$- $\Delta CCPI_t$)

Variable	Estimate	*p*-value
$COIN1_{t-1}$	**-0.103**	0.00
$\Delta FCPI_{t-1}$	0.229	0.00
Constant	-0.041	0.00
Diagnostic statistics		
R^2=0.40, SC=-6.2525, Q(6)=5.16(0.52), Q(12)=16.65(0.16), Q(24)=21.99(0.58), Q^2(6)=8.62(0.20), Q^2(12)=16.63(0.16), JB=0.05(0.97)		
Note: The same dummies as in Table 3 are included.		

Source: Author's calculations

The deviation of food prices from core prices is significantly equilibrium-adjusted toward long-run relation with oil prices and uncertainty. The monthly adjustment is estimated at around 10%.

Analysis of the dynamic structure based on SVAR model

To determine the dynamic impact of oil price and uncertainty shocks on food prices, VAR model is employed. The model includes the following variables: oil prices (OILP), indicator of macroeconomic uncertainty (MU), core price index (CCPI) and food price index (FCPI). Specifically, VAR(8) model with constant, trend, and eight impulse dummy variables is estimated. Number of lags is chosen according to the sequential testing of lags significance. Model contains impulse dummy variables that are designed to account for several one-time outliers. They are defined as: D1={1, for January 2009; 0, otherwise}, D2={1, for March 2011; 0, otherwise}, D3={1, for May 2012; 0, otherwise}, D4={1, for February 2015; 0, otherwise}, D5={1, for August 2016; 0, otherwise}, D6={1, for March 2020; 0, otherwise}, D7={1, for April 2020; 0, otherwise} and D8={1, for May 2020; 0, otherwise}. Several multivariate tests confirm that the model performs statistically well (Tables 5).

Table 5. Multivariate test statistics

Test for	Value	p-value
Autocorrelation of order 1	22.87	0.12
Autocorrelation of order 2	13.12	0.66
Autocorrelation of order 6	14.41	0.57
Autocorrelation of order 12	9.15	0.91
Normality	12.28	0.14
Note: Autocorrelation and normality results are obtained using the multivariate LM and multivariate Doornik-Hansen tests, respectively.		

Source: Author's calculations

Structural shocks are identified by imposing short-run restrictions that form a recursive model. The ordering of the variables is as follows: oil prices (OILP), indicator of macroeconomic uncertainty (MU), core price index (CCPI) and food price index FCPI It is assumed that the following restrictions apply: 1) Domestic shocks do not have contemporaneous effects on oil prices, 2) Only oil price shocks have contemporaneous effects on macroeconomic uncertainty, 3) Shocks in food price index do not have contemporaneous effects on core price index. The SVAR model is estimated, and the results indicate that oil price shocks do not have a statistically significant contemporaneous impact on core and food prices. Also, uncertainty shocks do not affect core prices within the same month. Consequently, three more zero restrictions are imposed on matrix that governs the contemporaneous interaction between variables (Λ_0).

$$\Lambda_0 = \begin{pmatrix} 1 & 0 & 0 & 0 \\ \lambda_0^{21} & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & \lambda_0^{42} & \lambda_0^{43} & 1 \end{pmatrix}$$

The structural parameters in matrix are estimated by maximum likelihood method (Table 6). The results indicate that a positive shock in oil prices corresponds to a reduction in macroeconomic uncertainty within the same month (λ_0^{21}). However, such an outcome can be explained by the huge exogenous shocks in 2008 and 2020, to which oil prices and uncertainty reacted in opposite directions. The partial correlation coefficient between these two variables, that controls the influence of two exogenous shocks, is in fact positive (0.12). The empirical findings suggest that shocks in macroeconomic uncertainty (λ_0^{42}) and core price index (λ_0^{43}) have a statistically significant contemporaneous impact on food prices. Specifically, an increase in macroeconomic uncertainty leads to a rise in food prices within the same month. Also, a positive shock in core price index causes food prices to rise within the same month. Imposed restrictions are accepted as empirical valid, because the likelihood ratio test statistic for overidentifying restrictions is 2.42 with the p-value 0.49.

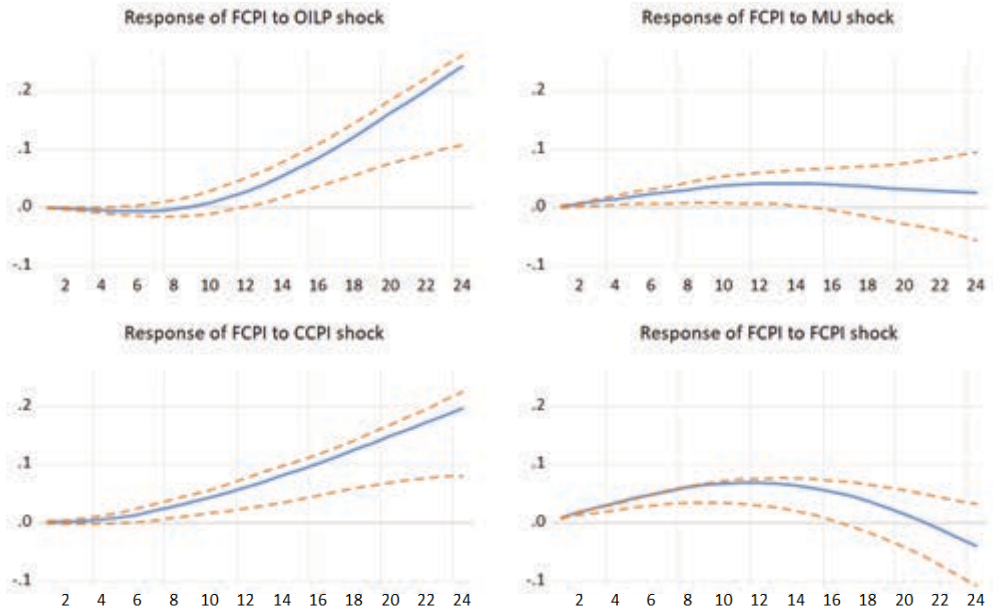
Table 6. Estimates of structural parameters

Structural parameters	Estimate	Std. error	z-statistic	p-value
λ_0^{21}	0.05	0.02	2.90	0.04
λ_0^{42}	-0.08	0.03	-2.73	0.01
λ_0^{43}	-0.74	0.38	-1.94	0.05

Source: Author's calculations

From the estimated SVAR, impulse response analysis and forecast error variance decomposition are performed. Figure 2 depicts accumulated impulse response functions for food price index. The results indicate that a positive shock in oil prices does not affect food prices in the first nine months. However, starting from the tenth month, a statistically significant positive effect is found. A positive shock in macroeconomic uncertainty has a statistically significant positive effect on food prices within the first year, whereas a positive shock in the core price index has a statistically significant positive impact on food prices even after two years.

Figure 2. Accumulated impulse response functions for food price index



Note: Orange lines represent 95% confidence intervals. They are calculated using standard percentile bootstrap with 1000 bootstrap repetitions.

Source: Author's calculations

Table 7 presents the results of the forecast error variance decomposition. The figures show the percentage of the forecast error variance of food price index that can be explained by individual shocks at different time horizons (1, 6, 9, 12, 18 and 24 months). The contribution of macroeconomic uncertainty is estimated at 17%, 16% and 12% for 6, 9 and 12 months respectively. For the 24 months horizon, however, the contribution of uncertainty drops to 3%. The results show that oil and core prices play a more important role as the time horizon increases. In particular, a 20% of fluctuations in food prices are explained by the oil price shock at a 12 months horizon, and 51% at a 24 months horizon. The contribution of the core price index is estimated at 23%, 31% and 24% for 9, 12 and 24 months respectively. Own shocks to food prices account for 56% of their own variability after 9 months and 22% after 24 months.

To summarize, the impact of uncertainty on the variability of food prices is greatest over a six-month period. After that its influence on the variability of food prices decreases. The influence of oil prices gradually increases and becomes the dominant factor in the variability of food prices after one and a half years.

Table 7. Forecast error variance decomposition of food price index (in %; values in each row sum to 100%)

Horizon (in months)	Shock in OILP	Shock in MU	Shock in CCPI	Shock in FCPI
1	0.1	4	2	93.9
6	2	17	10	71
9	5	16	23	56
12	20	12	31	37
18	47	5	29	19
24	51	3	24	22

Source: Author's calculations

Conclusions and discussions

The paper provides econometric results on multivariate time series modelling of food prices in Serbia over the period 2007-2022. The dynamics of food prices are examined using the dynamics of the following time series: core prices in Serbia, uncertainty about the macroeconomy in Serbia and world oil prices. Two different econometric aspects are considered. First, the long-run behavior of food prices in the context of cointegration is investigated. Second, the dynamic responses of food prices to exogenous shocks are discussed using SVAR.

The results indicate that food prices are determined in the long run by core prices, domestic uncertainty and world oil prices. While oil prices are the cost-driving factor, the indicator of macroeconomic uncertainty in Serbia provides a composite measure of macroeconomic instability that takes into account the effects of the various macroeconomic factors. An alternative interpretation of the cointegration result shows

that the deviation of food prices from core prices is explained in the long run by macroeconomic uncertainty and oil prices. The recent rise in food prices above the core price level can therefore be attributed to the positive impact of both oil prices and domestic macroeconomic uncertainty.

The long-run elasticity of domestic uncertainty is estimated at 0.36% and the long-run elasticity of oil prices at 0.09%. These estimates differ from the estimates in Chen, Gummi, Lu and Hassan (2024) for a panel of higher income oil-importing countries that includes Serbia (0.57% and 0.33% for global uncertainty and oil prices, respectively). These values are not directly comparable due to differences in the data structure, the methodology applied and the uncertainty concept used, but they at least confirm a positive significant reaction of food prices to uncertainty and global oil prices.

Looking at the dynamic response of food prices to unexpected random shocks in the considered variables, derived from the SVAR specification, main results show that over a one-year horizon about one third of the fluctuations in food prices can be attributed to the variability of shocks in uncertainty and oil prices. The relevance of these shocks increases with the time horizon, so that their relative influence is slightly more than half after two years.

The impact of uncertainty is greatest over a period of six months, after which it decreases. On the other hand, the influence of oil prices gradually increases and becomes the dominant factor in the variability of food prices after a year and a half. In the short term, therefore, uncertainty shocks play a more important role, but in the long term, oil price shocks predominate.

In Mladenović, Arsić & Nojković (2024), it was found that world energy prices significantly determine Serbian inflation as measured by the consumer price index. It is further argued that Serbia, as a small country that has no influence on global energy prices, can neutralize the negative effects of sharp fluctuations in world energy prices by concluding long-term energy contracts, building energy storage facilities and introducing administrative price control, especially in the short term. The same measures can be advocated as a control mechanism for food prices in times of high macroeconomic instability and rising oil prices.

Conflict of interests

The authors declare no conflict of interest.

References

1. Adeosun, O. A., Olayeni, R. O., Tabash, M. I., & Anagreh, S. (2023). Revisiting the oil and food prices dynamics: A time varying approach. *Journal of Business Cycle Research*, *19*, 275-309.
2. Bachmann, R., Elstner, S., & Sims, E. R. (2013). Uncertainty and economic activity: Evidence from business survey data. *American Economic Journal: Macroeconomics*, *5*, 217-249.

3. Baker, S. R., Bloom, N., & Davis, S. J. (2016). Measuring economic policy uncertainty. *The quarterly journal of economics*, *131*, 1593-1636.
4. Baumeister, C., & Kilian, L. (2014). Do oil price increases cause higher food prices?. *Economic Policy*, *29*, 691-747.
5. Ben Haddad, H., Mezghani, I., & Gouider, A. (2021). The dynamic spillover effects of macroeconomic and financial uncertainty on commodity markets Uncertainties. *Economies*, *9*, 91.
6. Bloom, N. (2009). The impact of uncertainty shocks. *Econometrica*, *77*, 623-685.
7. Bloom, N. (2014). Fluctuations in uncertainty. *Journal of economic Perspectives*, *28*, 153-176.
8. Chen, D., Gummi, U. M., Lu, S., & Hassan, A. (2024). Oil price, economic policy uncertainty and food prices in oil-exporting and oil-importing developing economies. *Economic Change and Restructuring*, *57*, 151.
9. Chen, D., Gummi, U. M., Lu, S. B., & Mu'azu, A. (2020). Modelling the impact of oil price fluctuations on food price in high and low-income oil exporting countries. *Agricultural Economics/Zemedelska Ekonomika*, *66*. 458–468.
10. Cho, J.S., Greenwood-Nimmo, M., & Shin, Y. (2023). Recent developments of the autoregressive distributed lag modelling framework. *Journal of Economic Survey*, 37. 7-32.
11. Ciaian, P. (2011). Food, energy and environment: Is bioenergy the missing link?. *Food Policy*, *36*, 571-580.
12. De Hoyos, R. E., & Medvedev, D. (2011). Poverty effects of higher food prices: a global perspective. *Review of Development Economics*, *15*, 387-402.
13. European Central Bank (2024). Economic Bulletin, Issue 2/2024. European Central Bank. https://www.ecb.europa.eu/press/economic-bulletin/html/eb202402.en.html
14. Fowowe, B. (2016). Do oil prices drive agricultural commodity prices? Evidence from South Africa. *Energy*, *104*, 149-157.
15. Frimpong, S., Gyamfi, E. N., Ishaq, Z., Kwaku Agyei, S., Agyapong, D., & Adam, A. M. (2021). Can global economic policy uncertainty drive the interdependence of agricultural commodity prices? Evidence from partial wavelet coherence analysis. *Complexity*, *2021*, 8848424.
16. Joëts, M., Mignon, V., & Razafindrabe, T. (2017). Does the volatility of commodity prices reflect macroeconomic uncertainty?. *Energy Economics*, *68*, 313-326.
17. Jurado, K., Ludvigson, S. C., & Ng, S. (2015). Measuring uncertainty. *American Economic Review*, *105*, 1177-1216.
18. Kilian, L. (2013). Structural Vector Autoregressions. In N. Hashimzade and M.A. Thornton (Eds.), *Handbook of Research Methods and Applications in Empirical Macroeconomics* (pp. 515-554). Cheltenham, UK, Edward Elgar.

19. Kilian, L. & Lutkepohl, H. (2017). *Structural Vector Autoregressive Analysis*, Cambridge University Press, New York.
20. Long, S., Li, J., & Luo, T. (2023). The asymmetric impact of global economic policy uncertainty on international grain prices. *Journal of Commodity Markets*, *30*, 100273.
21. National Bank of Serbia (2023). Inflation report February. National Bank of Serbia. Belgrade. Serbia. https://www.nbs.rs/export/sites/NBS_site/documents-eng/publikacije/ioi/izvestaji/inflation_report_02_2023.pdf
22. Nazlioglu, S., Erdem, C., & Soytas, U. (2013). Volatility spillover between oil and agricultural commodity markets. *Energy Economics*, *36*, 658-665.
23. Nazlioglu, S., & Soytas, U. (2011). World oil prices and agricultural commodity prices: Evidence from an emerging market. *Energy Economics*, *33*, 488-496.
24. Ozturk, E. O., & Sheng, X. S. (2018). Measuring global and country-specific uncertainty. *Journal of international money and finance*, *88*, 276-295.
25. Pesaran, M.H., Shin, Y., & Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of the Level Relationship*, Journal of Applied Econometrics, 16*, 289-326.
26. Rossi, B., & Sekhposyan, T. (2015). Macroeconomic uncertainty indices based on nowcast and forecast error distributions. *American Economic Review*, *105*, 650-655.
27. Serra, T., Zilberman, D., Gil, J. M., & Goodwin, B. K. (2011). Nonlinearities in the US corn-ethanol-oil-gasoline price system. *Agricultural Economics*, *42*, 35-45.
28. Shin, Y., Yu. B., & Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in nonlinear ARDL framework. In W. Horrace & R. Sicklers (Eds.). *Festschrift in Honor of Peter Schmidt: Econometric methods and applications* (pp. 281-314) New York, NY: Springer.
29. Statistical Office of the Republic of Serbia (2022). Household budget Survey. Statistical Office of the Republic of Serbia. Belgrade. Serbia. https://publikacije.stat.gov.rs/G2023/PdfE/G20235699.pdf
30. Šoškić, D. (2015). Inflation impact of food prices: Case of Serbia. *Economics of Agriculture*, *62*, 41-51.
31. Tiwari, A. K., Khalfaoui, R., Solarin, S. A., & Shahbaz, M. (2018). Analyzing the time-frequency lead lag relationship between oil and agricultural commodities. *Energy Economics, 76*, 470–494.
32. Wen, J., Khalid, S., Mahmood, H., & Zakaria, M. (2021). Symmetric and asymmetric impact of economic policy uncertainty on food prices in China: A new evidence. *Resources Policy*, *74*, 102247.
33. Zmami, M., & Ben-Salha, O. (2019). Does oil price drive world food prices? Evidence from linear and nonlinear ARDL modeling. *Economies*, *7*, 12.

PERCEPTION OF SMALL AND MEDIUM-SIZED HOTEL MANAGERS ON THE ECONOMIC FEASIBILITY OF PROCURING LOCAL AGRICULTURAL PRODUCTS

Slobodan Glišić[1], Predrag Stamenković[2]

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

ARTICLE INFO

Original Article

Received: *06 February 2025*

Accepted: *01 March 2025*

doi:10.59267/ekoPolj2501289G

UDC 640.4:338.488.2

Keywords:

Local procurement, hotel management, economic feasibility, sustainability, supply chain, consumer preferences, cost optimization

***JEL**: R23, Z32*

ABSTRACT

The study examines the economic feasibility of procuring local agricultural products in small and medium-sized hotels, emphasizing key factors influencing managerial decision-making. By integrating perceived cost savings, supplier reliability, customer demand, and regulatory support, this research provides a comprehensive framework for understanding the benefits and challenges of local sourcing in the hospitality sector. The empirical analysis is based on a survey conducted among hotel managers in Serbia, utilizing structural equation modeling (SEM) to assess the significance of proposed relationships. The findings confirm that supplier reliability and customer demand play a crucial role in shaping procurement decisions, while cost savings and regulatory support also contribute to economic feasibility. These results align with existing studies on sustainable procurement and local supply chains in tourism, reinforcing the importance of fostering stable partnerships between hotels and local producers.

Introduction

The hotel industry increasingly recognizes the importance of optimizing procurement chains to enhance business efficiency and improve service quality. One of the key aspects of this process is the procurement of local agricultural products, which can contribute to cost reduction, better quality control, and strengthened collaboration with local suppliers. Research has shown that managerial procurement decisions depend on various factors, including supply reliability, perceived economic feasibility, and regulatory support (Ghafourian et al., 2022; Gajić et al., 2023a,b). Additionally, adapting business models to market and consumer needs can be crucial for hotel competitiveness

1 Slobodan Glišić, Ph.D., Professor, Academy of Professional Studies South Serbia, Leskovac,16000, Serbia, Phone:+381606134100, E-mail: glisic.slobodan@vpsle.edu.rs, ORCID ID (https://orcid.org/0000-0002-0772-0831)

2 Predrag Stamenković, Ph.D., Professor, Academy of Professional Studies South Serbia, Leskovac 16000, Serbia, Phone:+381637331753, E-mail: stamenkovic.predrag@vpsle.edu.rs, ORCID ID (https://orcid.org/0009-0004-4669-1553)

(Wong, 2022). Although numerous studies have examined procurement strategies in the hospitality industry, the specific context of Serbia remains underexplored. There is a lack of data on how hotel managers perceive the economic feasibility of procuring local products, what factors influence their decisions, and to what extent regulatory frameworks facilitate or hinder this process. Previous studies suggest that business models can be adjusted to local conditions through innovative strategies and partnerships (Mehrotra & Jaladi, 2022; Gajić et al., 2023b), yet it remains unclear how willing hotel managers are to implement these approaches in practice.

The aim of this study is to analyze the key factors influencing hotel managers' decision-making regarding the procurement of local agricultural products. Specifically, the focus is on supplier reliability, perceived cost feasibility, expected guest demand, and regulatory support. By analyzing these factors, the study seeks to fill a gap in the literature and provide a deeper insight into the specific challenges and opportunities that arise in this process in Serbia. Unlike previous research that predominantly focuses on procurement practices in large hotel chains or international markets, this study offers a novel perspective by examining small and medium-sized hotels in Serbia. These establishments face distinct economic and logistical constraints that influence their procurement strategies, yet they are often overlooked in academic discussions. By analyzing the interplay of supplier reliability, cost efficiency, guest demand, and regulatory support, this study provides an integrative framework that captures the complexities of local procurement within this unique market segment. Furthermore, it offers practical insights into how procurement strategies can be optimized in response to market-specific conditions, thereby contributing to the growing discourse on sustainable supply chain management in the hospitality sector. Despite the recognized benefits of local procurement, hotel managers face multiple challenges when making sourcing decisions, ranging from cost considerations to supplier reliability and regulatory constraints. Understanding their perceptions of economic feasibility and the factors shaping their procurement choices is crucial for developing sustainable procurement strategies. In this context, the key research question arises:

To what extent do hotel managers perceive the economic feasibility of sourcing local agricultural products, and what are the main challenges influencing their procurement decisions?

Although several studies have examined procurement strategies in the hospitality industry, this study provides a unique contribution by specifically analyzing small and medium-sized hotels in Serbia. Unlike previous research that focused primarily on large hotel chains or international markets, this study highlights the specific economic and regulatory challenges faced by local hotel managers. By integrating managerial decision-making factors into a structured framework, it extends existing literature on sustainable procurement and hotel supply chain management.

Theoretical background

The importance of integrating local agricultural products into the hotel industry

The integration of local agricultural products into the hotel industry represents a significant strategic approach that enables the enhancement of gastronomic quality, cost optimization, and the strengthening of connections between hotels and the local community (Thomas-Francois et al., 2017). Small and medium-sized hotels, in particular, can benefit from using local products, as this allows them to differentiate their offerings and align with contemporary tourist preferences, which increasingly emphasize authenticity and sustainability (Chen, 2022; Prevolšek et al., 2024).

Short supply chains play a crucial role in the economic aspect of sourcing local products, as they reduce dependence on intermediaries and facilitate direct collaboration with producers. This model not only contributes to lowering transportation and storage costs but also increases the freshness and quality of ingredients used in hotel restaurants (Berti, 2020). Additionally, transparency in the supply chain fosters guest trust, as tourists are increasingly interested in the origin of their food and the methods of its production (Sigala, 2014).

Beyond economic advantages, integrating local products enhances the competitive position of hotels by creating unique gastronomic experiences. Authentic cuisine becomes an essential component of the tourism offer, allowing guests to engage with the local culture and traditions through gastronomy (Vukolić et al., 2023; Recuero-Virto & Arróspide, 2024). Hotel restaurants that feature dishes made from local ingredients can foster greater guest loyalty, as tourists increasingly prefer hotels that provide sustainable and high-quality food adapted to local specificities (Baratta & Simeoni, 2021).

In addition to economic and marketing benefits, the use of local agricultural products contributes to the sustainability of hotel operations (Chung, 2020). Reducing the transportation of goods over long distances has a positive impact on environmental protection by lowering carbon dioxide emissions and minimizing the negative ecological effects of global supply chains. Sustainable food procurement approaches are becoming part of a broader strategy for responsible hotel operations, which can enhance brand perception and attract environmentally conscious tourists (Han, 2020; Wong, 2022).

Despite numerous advantages, the process of integrating local agricultural products can be challenging due to the seasonality of supply, variations in product quality, and logistical constraints. Small and medium-sized hotels often face difficulties in maintaining a consistent supply, as local producers may not always have the capacity to meet constant demand (Panno, 2020). Moreover, the higher price of local products compared to mass-produced alternatives can pose a challenge to achieving optimal economic sustainability.

Managing these challenges requires well-planned procurement strategies, the development of partnerships with producers, and the adaptation of menus to seasonal products (Sutomo & Mukhlis, 2023). Hotels that successfully integrate local agricultural products into their offerings can achieve long-term benefits, including increased attractiveness of their gastronomic offer, improved relationships with the local community, and enhanced sustainability in an increasingly competitive tourism sector (Enzenbacher, 2020; Meneguel et al., 2022).

Economic feasibility in the hotel industry

Economic feasibility represents one of the key factors in the sustainability and successful operation of hotels, with particular attention given to cost optimization, revenue growth, and efficient resource management (Khalil et al., 2024). Small and medium-sized hotels face challenges in achieving financial stability, as they often operate with limited budgets and depend on seasonal fluctuations in demand (Okeke et al., 2024). Therefore, efficient management of economic feasibility is crucial for the long-term sustainability of their business operations.

One of the fundamental aspects of economic feasibility in the hotel industry relates to the rationalization of operational costs through procurement optimization, waste reduction, and efficient inventory management. Direct collaboration with local producers can contribute to lowering food procurement costs, eliminating intermediaries, and improving the quality of products used in hotel services (Obrenovic et al., 2020; Bhattacharya et al., 2024). Additionally, investments in energy-efficient systems and sustainable operational practices can reduce fixed costs in the long run and increase hotel profitability (Pantić et al., 2021; Orynycz & Tucki, 2021).

Revenue growth through service diversification and adaptation to market trends is another important aspect of economic feasibility. Hotel restaurants, wellness centers, event organization, and additional tourist activities can help generate new revenue streams, thereby reducing reliance on accommodation services alone (Scheyvens & Laeis, 2022; Khalil et al., 2024). The personalization of services and the application of digital technologies in guest communication enable more precise targeting of customer segments and increased satisfaction, leading to higher rates of repeat visits and recommendations (Das et al., 2024).

Seasonality presents a significant challenge to economic feasibility in the hotel industry, particularly for small and medium-sized hotels located in destinations with pronounced seasonal fluctuations. To mitigate the risk of revenue decline during off-peak periods, hotels implement flexible pricing strategies, create special packages for guests, and develop loyalty programs that encourage bookings throughout the year (Dalir, 2024). Additionally, service diversification through the organization of themed events, gastronomic festivals, or business conferences can significantly reduce the impact of seasonality on business performance (Kwiatkowski et al., 2024).

Labor cost management is another factor that significantly affects the economic feasibility of hotels (Yacoub & ElHajjar, 2021). Optimizing workforce deployment through efficient shift planning, investing in employee training, and utilizing automation technologies for certain operations can lead to substantial reductions in operational costs. The implementation of modern software solutions for reservation and hotel operations management contributes to better cost control and increased business efficiency (Dyshkantiuk et al., 2020).

The long-term sustainability of economic feasibility in the hotel industry depends on the ability to adapt to market changes, innovate in service offerings, and strategically manage resources. Hotels that successfully balance cost optimization with service quality improvements can gain a competitive advantage and achieve long-term financial stability in a dynamic and challenging business environment (Bardukova, 2023; Khalil et al., 2024).

Sustainability and local supply chains

Sustainability in the hotel industry is becoming one of the key factors for long-term development, with local supply chains playing a central role in achieving ecological, economic, and social responsibility (Achmad & Yulianah, 2022). The use of local agricultural products in hotel offerings not only contributes to reducing negative environmental impacts but also strengthens the economic stability of local communities and improves the quality of gastronomic services (Maynard et al., 2020).

Local supply chains enable hotels to reduce carbon dioxide emissions resulting from the long-distance transportation of goods, thereby directly contributing to environmental protection. Using products sourced from the immediate surroundings helps preserve biodiversity, reduce packaging waste, and support sustainable agriculture (Xia et al., 2022). Moreover, eliminating long distribution chains reduces the need for storage and extended food processing, thereby improving the nutritional value of products used in hotel restaurants (Xia et al., 2022; Omar et al., 2024).

The economic sustainability of local supply chains is reinforced by the fact that direct collaboration with producers eliminates intermediaries, allowing hotels to procure fresh products at competitive prices (Ciulli et al., 2020). At the same time, this cooperation fosters the development of small and medium-sized agricultural enterprises, strengthening the local economy and reducing dependence on global market fluctuations. The hotel sector, particularly when relying on local resources, can contribute to creating a stable market for small producers, thereby promoting sustainable economic development in rural areas (Polukhina et al., 2021).

In addition to ecological and economic benefits, local supply chains enhance the destination's identity through an authentic gastronomic offering. The use of local products allows hotels to develop unique menus based on traditional recipes and seasonal ingredients, increasing the destination's attractiveness and encouraging guest interest in local culture (Vukolić et al., 2023; Stalmirska, 2024). This practice can positively

influence the perception of service quality, increase guest loyalty, and contribute to better hotel promotion through recommendations and digital communication channels (Van Huy & Thai Thinh, 2024).

Although local supply chains offer numerous advantages, their implementation in the hotel industry can be challenging due to the seasonality of production, inconsistent product quality, and limited capacities of small producers (Liu & Li, 2024). Hotels often need to adjust their procurement strategies to ensure a continuous supply and align their offerings with market fluctuations (Santa et al., 2025). Maintaining long-term partnerships with local producers, investing in logistical infrastructure, and flexibly adapting menus to seasonal products are key strategies for successfully integrating local supply chains (Marusak et al., 2021; Liu & Li, 2024).

Sustainability in the hotel industry is becoming an increasingly important criterion for guests, who are increasingly considering ecological and social aspects when choosing accommodations (Floričić, 2020). The integration of local products into hotel offerings is not only an economically viable practice but also a way for hotels to respond to the growing demand for sustainable and authentic tourism experiences (Chen, 2022).

Theories of managerial decision-making in procurement

Managerial decision-making in hotel procurement is a complex process that requires the analysis of multiple factors, including cost efficiency, supply reliability, customer preferences, and regulatory frameworks. Procurement decisions affect not only the operational performance of hotels but also their competitive position, business sustainability, and guest perception of service quality (Vasilakakis & Sdrali, 2023). Efficient procurement management enables hotels to optimize costs, ensure a stable supply chain, and respond to market trends that shape demand for specific product categories (Ceynowa et al., 2024). In a theoretical context, managerial procurement decisions can be examined through several key dimensions: perceived cost savings (Perceived Cost Savings – PCS), supply reliability (Supplier Reliability – SR), customer demand (Customer Demand – CD), and regulatory support (Regulatory Support – RS). These dimensions play a crucial role in shaping hotel procurement strategies, with each factor having a different impact on operational and financial performance (Mohammed et al., 2022; Ceynowa et al., 2024).

Cost efficiency is one of the most important factors in procurement decision-making, as it directly influences hotel profitability. Managers choosing between global and local suppliers consider perceived cost savings a critical factor, as reducing expenses on transportation, eliminating intermediaries, and securing more flexible payment terms can improve financial outcomes (Cho, 2021). The use of local agricultural products, therefore, represents a potential cost-saving strategy, particularly in markets where logistics costs significantly impact overall operational efficiency. However, uncertainties related to price volatility, supply seasonality, and the limited production capacity of local suppliers may create financial risks that need to be managed strategically (Mishra et al.,

2022). Given that perceived cost savings play a crucial role in determining procurement feasibility, this study examines whether hotel managers' cost perceptions positively influence their willingness to source locally, thereby reinforcing the assumption that cost efficiency is a key determinant of procurement decisions.

H1: Perceived cost savings positively impact the economic feasibility of local procurement.

Supply reliability plays a crucial role in hospitality, as a consistent procurement process directly affects service quality and operational efficiency. Hotel managers must assess the stability of their suppliers, their ability to deliver products on schedule, and the consistency of product quality to ensure uninterrupted business operations and guest satisfaction (Le et al., 2021). While traditional global distribution networks offer stable supply chains and standardized products, they remain vulnerable to market fluctuations, transport disruptions, and external crises, which can jeopardize procurement efficiency (Vasilakakis & Sdrali, 2023). In contrast, sourcing from local suppliers may enhance flexibility and responsiveness, but it also introduces risks related to production capacity, seasonal availability, and infrastructure limitations. Since procurement decisions depend on the perceived reliability of suppliers and their ability to consistently meet demand, this study examines whether hotel managers prioritize supply stability when selecting local producers. This assumption is empirically tested through:

H2: Supplier reliability significantly influences hotel managers' procurement decisions.

Guest demand has a direct impact on managerial procurement decisions, as hotel restaurants and food service sectors must adapt their offerings to market preferences to ensure high satisfaction and customer loyalty. The increasing awareness of healthy eating, sustainability, and food origin has led to growing demand for local, organic, and seasonal products, prompting hotels to reconsider their sourcing strategies (Kim & Han, 2022). Consumers, particularly those seeking authentic and environmentally responsible experiences, increasingly prefer hotels that incorporate locally sourced ingredients into their menus. This shift in consumer expectations not only influences purchasing trends but also pressures hotels to align their procurement decisions with market demand. Given that guest preferences directly shape the feasibility of local sourcing, this study examines whether increasing demand for local products encourages hotel managers to integrate them into their supply chains. This assumption is empirically tested through:

H3:Guest demand plays a crucial role in determining the feasibility of sourcing local products.

The regulatory framework and institutional support play a significant role in shaping hotel procurement strategies. Government policies, subsidies, and support programs for local producers can significantly influence hotels' decisions to incorporate domestic agricultural products into their offerings (Japutra & Situmorang, 2021). In many countries, initiatives encourage hotels to use local resources through tax incentives, financial support, and regulations promoting sustainable agriculture (Li et al., 2024).

Hotel managers must monitor regulatory changes, collaborate with relevant institutions, and leverage available incentives to maximize the economic and operational benefits of a sustainable procurement strategy. Proper alignment with the legal framework ensures hotels' long-term business stability and better integration into the local economy (Hussein et al., 2024).

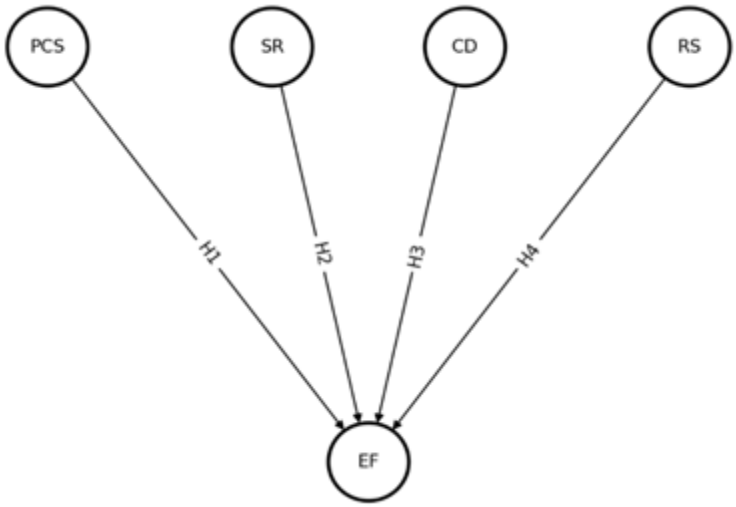
H4:Regulatory support facilitates the integration of local agricultural products into hotel supply chains.

Existing literature on integrating local agricultural products into the hotel industry presents varying perspectives and findings, highlighting the complexity of this topic (Ammirato et al., 2020). While many studies emphasize the benefits of using local products, such as enhanced service quality, support for local economies, and reduced environmental impact, others point to challenges and potential drawbacks of this approach (Cvijanović et al., 2020).

One of the key arguments against local product integration relates to economic feasibility. Some studies suggest that procuring local products can increase hotel operational costs due to higher prices, seasonal supply variations, and limited capacities of local producers (Alrawabdeh, 2021). These factors can negatively impact profitability, especially for smaller hotels with constrained budgets.

These contradictory findings underscore the need for further research and careful consideration when making decisions about integrating local agricultural products into hotel offerings. Each hotel should conduct a thorough analysis of its operational capacities, market characteristics, and the availability of local resources to determine the most optimal approach that balances the advantages and potential challenges of this concept (Khalil et al., 2024).

Figure 1. Theoretical model

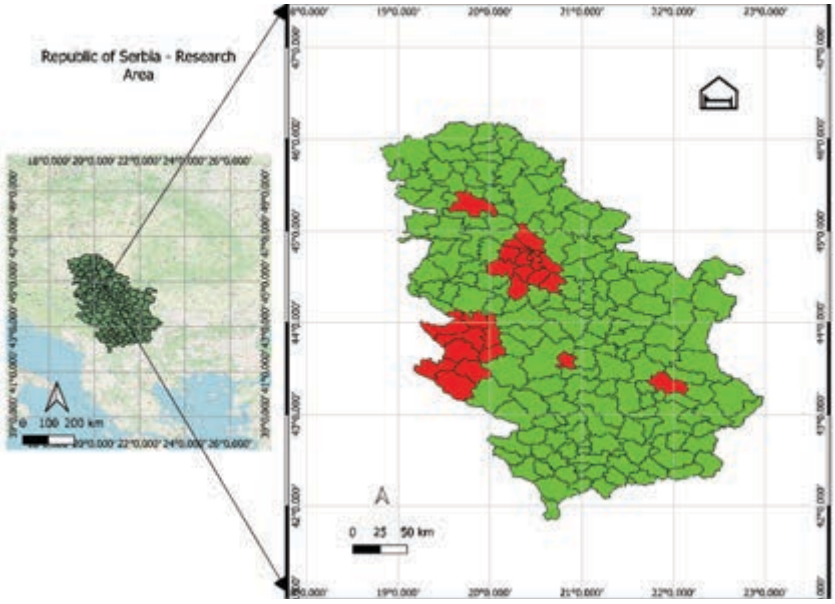


Methodology

Sample and procedure

The study was conducted on a sample of 463 managers employed in small and medium-sized hotels in Serbia, aiming to analyze their perception of the economic feasibility of procuring local agricultural products. The sample was carefully designed to include managers from various hotel business sectors, including general managers, F&B managers, operations managers, and procurement managers, ensuring a comprehensive overview of attitudes and challenges related to the integration of local products into hotel offerings. Data were collected exclusively in the field through face-to-face surveys conducted between August and December 2024 across five key tourist destinations in Serbia: Belgrade, Novi Sad, Kopaonik, Zlatibor, Niš, and Vrnjačka Banja. These destinations were strategically selected as they represent major urban and mountain tourism centers with a well-developed hospitality industry and significant potential for collaboration with local agricultural producers. Respondents were approached through direct hotel visits, with prior announcements and coordination with managerial teams to ensure active participation and relevant responses.

Figure 2. Research area



The data were collected through structured, on-site surveys. The questionnaire was designed to include demographic information about respondents, their attitudes toward the procurement of local agricultural products, and the key factors influencing their perception of the economic feasibility of this supply model. To mitigate moral hazard, which can arise in studies of this nature, responses were collected anonymously, with respondents explicitly informed that there were no correct or socially desirable answers.

The purpose of the research was to provide an objective analysis of market conditions and managerial perspectives. A pilot study was conducted in July 2024 with a smaller sample of 30 managers from Belgrade, Novi Sad, and Zlatibor to test the clarity and relevance of the questionnaire. The results indicated that some questions required additional refinement and adaptation to industry-specific terminology. Based on respondent feedback, minor adjustments were made to improve the clarity and precision of statements, ensuring that the final questionnaire aligned with the study's objectives. Most respondents had between six and fifteen years of experience in the hospitality sector, with an average age ranging from 34 to 43 years. The educational background of the sample revealed that the majority held undergraduate and master's degrees, while a smaller portion had secondary or doctoral education. The hotels in which they were employed primarily belonged to the 2- to 4-star category, with capacities ranging from 10 to 80 rooms. The most represented positions among respondents were operational and general managers (Table 1).

Table 1. Socio-demographic characteristics of respondents

Position	Hotel Size	Location	Years of Experience	Age	Education	Hotel Category
Operations Manager	20-50 rooms	Tourist region	11	38	MSc	3*
Procurement Manager	10-30 rooms	Urban	12	37	Bachelor's	2*
General Manager	30-50 rooms	Rural	6	35	High School	4*
Operations Manager	20-50 rooms	Urban	8	39	Bachelor's	3*
F&B Manager	10-30 rooms	Rural	8	38	Bachelor's	2*
General Manager	30-80 rooms	Urban	14	41	MSc	4*
Procurement Manager	10-30 rooms	Tourist region	9	36	PhD	3*
General Manager	20-50 rooms	Rural	15	43	Bachelor's	4*
Operations Manager	10-30 rooms	Urban	10	35	High School	2*
F&B Manager	30-80 rooms	Tourist region	7	34	Bachelor's	3*

Source: Authors' research

Measurements

The study employs a structured questionnaire to measure key constructs related to hotel managers' perceptions of the economic feasibility of procuring local agricultural products. The measurement items were adapted from existing literature to ensure construct validity and relevance to the hospitality industry. Specifically, statements related to Perceived Cost Savings (PCS) were modified from studies on procurement

efficiency in tourism supply chains (e.g., Chatzitheodoridis & Kontogeorgos, 2020), while Supplier Reliability (SR) constructs were derived from research on supply chain stability (e.g., Susila et al., 2024). Customer Demand (CD) items were adapted from studies analyzing tourist food preferences (Scheyvens & Laeis, 2022), and Regulatory Support (RS) constructs were modified based on prior research on policy incentives for local sourcing (Yi et al., 2024). The dependent variable, Economic Feasibility (EF), was developed based on studies evaluating the financial benefits of local procurement in the hospitality sector (Wondirad et al., 2021). A five-point Likert scale was used to measure all constructs, ranging from 1 (strongly disagree) to 5 (strongly agree). This approach ensures consistency in responses and allows for reliable comparison of managers' perceptions. The questionnaire consisted of 15 items distributed across five constructs.

Data Analysis

The data were analyzed using SPSS 26.00 for descriptive statistics and SmartPLS 4 for structural equation modeling (SEM). In the initial phase, a thorough examination of the data was conducted to assess response characteristics and ensure the initial validation of variable distribution. Mean values (M) and standard deviations (SD) were calculated for all questionnaire items, allowing an analysis of central tendency and data variability. Particular attention was given to identifying potential outliers and extreme values to ensure that the dataset was not subject to significant deviations that could impact further factor analysis. An Exploratory Factor Analysis (EFA) was performed to identify the latent structure of the variables reflecting hotel managers' perceptions of the economic feasibility of procuring local agricultural products (Widaman, & Helm, 2023). The suitability of the data for factor analysis was confirmed using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (0.861) and Bartlett's test of sphericity ($\chi^2 = 512.376$, df = 105, $p < 0.001$), indicating appropriate correlations among variables (Sürücü et al., 2022). Factors were extracted using the Principal Component Analysis (PCA) method, retaining only those with eigenvalues greater than 1, in accordance with Kaiser's criterion (Marsh et al., 2019). A Varimax rotation was then applied to improve factor interpretation and reduce cross-loadings. The final factor solutions included only indicators with factor loadings greater than 0.30, while those with high cross-loadings were eliminated to ensure clear differentiation between factors (Sürücü et al., 2022). The obtained factor structure identified five key dimensions influencing managers' perceptions of economic feasibility in local procurement, forming the foundation for further Confirmatory Factor Analysis (CFA) and construct validity assessment (Widaman & Helm, 2023). For CFA, validation metrics were tested to confirm convergent and discriminant validity, as well as overall model fit. The results showed that the Average Variance Extracted (AVE) for all factors exceeded the recommended threshold of 0.50, confirming that the indicators adequately explained their latent constructs (Canivez et al., 2020). Correlation analysis among factors further demonstrated that none exhibited overlap greater than their AVE values, ensuring that constructs measured distinct concepts and confirming discriminant validity (Marsh et al., 2019). To evaluate the model fit, standard goodness-of-fit indicators were analyzed.

The Chi-square test yielded $\chi^2 = 254.678$ with 84 degrees of freedom ($p < 0.001$) (Beauducel & Wittmann, 2005).

The Comparative Fit Index (CFI) was 0.945, while the Tucker-Lewis Index (TLI) was 0.932, both exceeding the recommended threshold of 0.90. Additionally, the Root Mean Square Error of Approximation (RMSEA) was 0.054, falling within the acceptable range of < 0.08, while the Standardized Root Mean Square Residual (SRMR) was 0.048, confirming adequate model fit (Canivez et al., 2020). These results further validated the factor structures identified in the EFA phase, ensuring the reliability and validity of the constructs used in the study. As part of the CFA, a multicollinearity check was performed to ensure the independence of indicators and reduce the risk of redundancy among variables. The Variance Inflation Factor (VIF) values ranged between 1.24 and 3.32, indicating no serious multicollinearity issues, as all values remained below the critical threshold of 5. Additionally, Standardized Regression Weights (SRW), measuring the strength of relationships between latent factors and their indicators, ranged from 0.67 to 0.88, confirming that all indicators reliably predicted their associated factors (Marsh et al., 2019).

Finally, SEM analysis in SmartPLS 4 was used to examine the relationships among key factors influencing the economic feasibility of local procurement in small and medium-sized hotels (Pering, 2020). The model was evaluated to confirm construct validity and reliability, as well as to analyze direct, indirect, and total effects among the studied variables.

Results

Results of descriptive and factor analysis

The results of the reliability and convergent validity analysis confirm the consistency and stability of all measured factors. All constructs demonstrated satisfactory Cronbach's alpha (α) values, indicating strong internal consistency (Table 2). The perceived cost savings (PCS) factor showed moderately high mean values, with the highest-rated statement being that local product transportation is cheaper than imported products (m = 4.89, sd = 0.90), highlighting managers' recognition of economic benefits. Supplier reliability (SR) exhibited strong reliability (α = 0.902), with managers acknowledging the feasibility of long-term cooperation with local suppliers (m = 4.55, sd = 0.98) and their overall reliability (m = 4.36, sd = 1.10). Customer demand (CD) emerged as a significant factor, with high mean values and strong correlations. Guests strongly prefer meals made from local ingredients (m = 4.20, sd = 0.88), and their use positively influences guest loyalty (m = 4.10, sd = 1.02). Regulatory support (RS) showed slightly lower mean scores, with the highest-rated statement regarding government subsidies (m = 3.85, sd = 1.15), suggesting limited institutional support for integrating local products into hotel operations. Economic feasibility (EF) demonstrated the highest reliability (α = 0.941), with strong managerial perceptions of the financial benefits of local procurement. The statement that collaboration with local producers improves hotel economic sustainability (m = 4.50, sd = 0.78) further reinforces managers' recognition of the long-term advantages of this approach.

Table 2. Reliability and convergent validity test

Factor	Abbreviation	Statement	m	sd	α	λ
Perceived Cost Savings (PCS)	PCS1	Procuring local products reduces costs compared to imported ones.	4.44	1.21	0.756	0.714
	PCS2	Collaboration with local suppliers enables more flexible pricing.	3.84	1.44	0.715	0.766
	PCS3	Transporting local products is cheaper than transporting imported products.	4.89	0.90	0.743	0.800
Supplier Reliability (SR)	SR1	Local suppliers regularly deliver high-quality products.	4.91	0.80	0.902	0.700
	SR2	The reliability of supply from local producers is high.	4.36	1.10	0.802	0.858
	SR3	It is possible to establish long-term cooperation with local suppliers.	4.55	0.98	0.895	0.831
Customer Demand (CD)	CD1	Hotel guests prefer meals prepared with local ingredients.	4.20	0.88	0.918	0.820
	CD2	The use of local products increases guest satisfaction.	4.45	0.76	0.873	0.812
	CD3	Marketing local products contributes to guest loyalty.	4.10	1.02	0.929	0.854
Regulatory Support (RS)	RS1	Government subsidies encourage the use of local products in hotels.	3.85	1.15	0.815	0.741
	RS2	There are incentives for hotels that use local agricultural products.	3.75	1.22	0.789	0.760
	RS3	The regulatory framework supports short supply chains in the hospitality industry.	4.00	1.10	0.854	0.799
Economic Feasibility (EF)	EF1	The use of local agricultural products contributes to increasing hotel revenue.	4.35	0.90	0.941	0.881
	EF2	Collaboration with local producers improves the economic sustainability of hotels.	4.50	0.78	0.922	0.859
	EF3	Integrating local products reduces overall hotel operating costs.	4.25	0.95	0.903	0.832

*Note: m – arithmetic mean, sd – standard deviation, α - Cronbach alpha, λ – factor loading
Source: Authors' research

The reliability and convergent validity analysis confirm the robustness of the measured constructs (Table 3). Cronbach's alpha (α) values for all factors exceed the acceptable threshold of 0.7, indicating strong internal consistency. Composite reliability (CR) values further validate the reliability of each construct, with all exceeding 0.8, confirming the stability of the measurement model. The average variance extracted (AVE) values range from 0.522 to 0.710, meeting the recommended threshold of 0.50, which suggests that

the indicators adequately explain their respective latent constructs. Eigenvalues confirm that each factor explains a significant portion of the variance, with perceived cost savings (PCS) explaining the highest proportion (23.252%), followed by supplier reliability (SR) (21.842%) and customer demand (CD) (20.893%). The cumulative variance explained by the factors reaches 99.673%, demonstrating the strong explanatory power of the model.

Table 3. Reliability and convergent validity test for the factors

Factor	m	sd	α	Eigen Value	% Variance	Cumulative %	CR	AVE
Perceived Cost Savings (PCS)	4.39	1.18	0.738	3.402	23.252	22.859	0.860	0.710
Supplier Reliability (SR)	4.46	0.92	0.864	3.195	21.842	45.166	0.844	0.643
Customer Demand (CD)	4.01	0.93	0.810	3.057	20.893	65.777	0.822	0.522
Regulatory Support (RS)	4.50	0.77	0.857	2.904	19.852	86.317	0.916	0.646
Economic Feasibility (EF)	3.89	1.03	0.839	2.072	14.161	99.673	0.852	0.696

*Note: m – arithmetic mean, sd – standard deviation, α - cronbach alpha, CR - composite reliability, AVE - average variance extracted.

Source: Authors' research

The matrix displays correlations among variables, with all values being positive. The strongest relationship is between PCS and SR (0.775), while the weakest is between PCS and EF (0.378). Correlations range from moderate to high, with no indications of extreme multicollinearity (Table 4).

Table 4. Correlations among variables

	PCS	SR	CD	RS	EF
PCS	**1.000**	0.775	0.666	0.599	0.378
SR	0.775	**1.000**	0.733	0.601	0.654
CD	0.666	0.733	**1.000**	0.406	0.391
RS	0.599	0.601	0.406	**1.000**	0.446
EF	0.378	0.654	0.391	0.446	**1.000**

*Note: the diagonal is the AVE square root of each construct

Source: Authors' research

Results of SEM analysis

Table 5 presents the results of the Fornell-Larcker criterion (below the diagonal) and Heterotrait-Monotrait (HTMT) values (above the diagonal), while the diagonal contains the squared AVE values. All square roots of AVE values (diagonal) are higher than the corresponding correlations between constructs, confirming discriminant validity according to the Fornell-Larcker criterion. Additionally, all HTMT values remain below the 0.85 threshold, further supporting construct differentiation. These results indicate that each latent construct measures a distinct concept without overlap with others, reinforcing the model's reliability in analyzing the relationships between variables.

Table 5. Fornell-Larcker and HTMT values

	PCS	SR	CD	RS	EF
PCS	**0.843**	0.853	0.733	0.659	0.416
SR	0.775	**0.802**	0.806	0.661	0.719
CD	0.666	0.733	**0.722**	0.447	0.430
RS	0.599	0.601	0.406	**0.804**	0.491
EF	0.378	0.654	0.391	0.446	**0.834**

Source: Authors' research

The results of the model fit analysis indicate that the χ^2/df ratio of 2.249 suggests an acceptable fit of the data to the model. The RMSEA value of 0.078 further confirms a good fit, while the high CFI value of 0.966 indicates that the model effectively explains data variability. The low SRMR value of 0.054 suggests minimal differences between the predicted and observed values, and the NFI value of 0.950 confirms the adequacy of the model structure. The coefficient of determination (R^2) of 0.531 implies that the model explains more than half of the variance of the dependent variable, while the Q^2 value of 0.583 demonstrates the model's strong predictive relevance.

The structural path analysis confirms all proposed hypotheses, highlighting significant relationships between key factors and the economic feasibility (EF) of procuring local agricultural products. Supplier reliability (SR) has the strongest influence on EF (β = 0.770, t = 2.849, p = 0.027), confirming that the perceived stability and reliability of local suppliers play a crucial role in managerial decision-making. Similarly, customer demand (CD) positively impacts EF (β = 0.639, t = 2.727, p = 0.022), suggesting that managers recognize the benefits of integrating local products into hotel offerings in response to guest preferences. Perceived cost savings (PCS) also show a significant positive effect on EF (β = 0.425, t = 5.330, p = 0.016), supporting the idea that managers value the potential for cost optimization through local procurement. Finally, regulatory support (RS) has a moderate but significant impact on EF (β = 0.559, t = 2.734, p = 0.015), indicating that government subsidies and legal incentives play an important but not decisive role in procurement decisions. All obtained results show appropriate effect sizes (f^2), with SR exhibiting the highest effect (f^2 = 0.276), while the other factors demonstrate moderate to low effects. These findings confirm that managers recognize the value of local procurement through cost efficiency, supply reliability, guest demand, and regulatory support, thereby validating the proposed model (Table 6).

Table 6. Path analysis and hypothesis testing

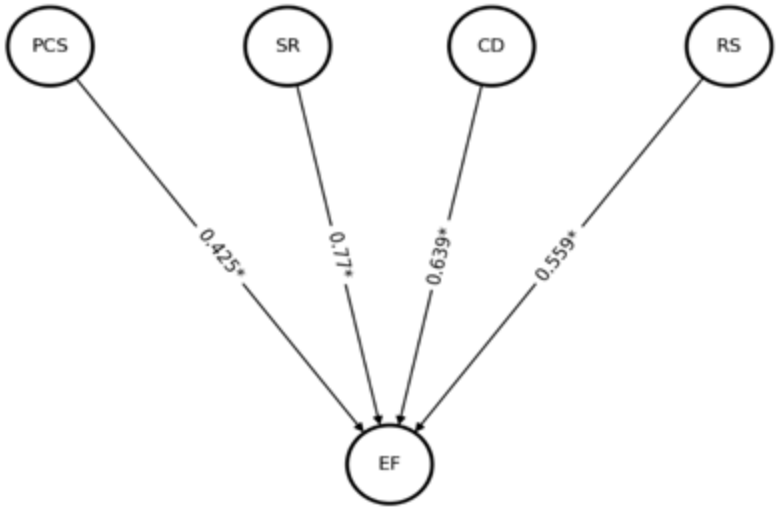
Hypothesis	Path	β	m	sd	t	p	f^2	Confirmation
H1	PCS → EF	0.425	0.436	0.921	5.330	0.016	0.149	supported
H2	SR → EF	0.770	0.734	0.996	2.849	0.027	0.276	supported
H3	CD → EF	0.639	0.618	0.514	2.727	0.022	0.198	supported
H4	RS → EF	0.559	0.546	1.179	2.734	0.015	0.132	supported

Source: Authors' research

The final model demonstrates significant positive relationships between the four predictor variables (PCS, SR, CD, and RS) and economic feasibility (EF). Supplier reliability (SR) has the strongest impact (β = 0.770), highlighting the crucial role of dependable local suppliers. Customer demand (CD) and regulatory support (RS) also contribute significantly (β = 0.639 and β = 0.559, respectively), while perceived cost savings (PCS) shows a moderate but significant effect (β = 0.425).

These results confirm the validity of the research framework, emphasizing the importance of these factors in hotel managers' decision-making regarding the procurement of local agricultural products (Figure 3).

Figure 3. Final model



Source: Authors' research

Discussion

The findings of our study provide valuable insights into the economic feasibility of procuring local agricultural products for small and medium-sized hotels. The results emphasize the key role of cost reduction, supplier reliability, customer demand, and regulatory support in shaping managerial decisions, aligning with previous research. The strong positive impact of supplier reliability on economic feasibility highlights the importance of stable and efficient supply chains. These findings are consistent with Susila et al. (2024), who underscored the significance of interconnectivity and efficient supply chains in agro-tourism development. Our study confirms that supplier reliability is not only crucial for agro-tourism but also plays a decisive role in procurement decisions in the hospitality industry.

The influence of customer demand on economic feasibility further indicates that hotels recognize the importance of adjusting to guest preferences, particularly when it comes to local products. This is in line with Scheyvens and Laeis (2022), who emphasized

the importance of integrating local food production into tourism offerings to support sustainability goals. Similarly, Wondirad et al. (2021) highlighted that culinary tourism contributes to regional economic growth and socio-cultural revitalization, reinforcing our conclusion that demand for local products positively affects economic feasibility. A moderate yet significant impact of perceived cost savings on economic feasibility highlights the financial appeal of local procurement. These findings are in agreement with Chatzitheodoridis and Kontogeorgos (2020), who demonstrated that small-scale tourism ventures can leverage local resources to maintain economic stability during periods of uncertainty. Our study further confirms that opportunities for cost reduction through local sourcing can contribute to the financial sustainability of the hospitality sector.

Regulatory support also plays a crucial role in improving economic feasibility. These results align with Yi et al. (2024), who emphasized the importance of government incentives and support mechanisms in promoting rural tourism and strengthening linkages between local communities and the tourism sector. Our study extends this understanding by highlighting the role of regulatory frameworks in shaping managerial decisions regarding the integration of local products. Overall, our findings validate the proposed research model, demonstrating that cost efficiency, supplier reliability, customer preferences, and regulatory incentives collectively influence managerial decision-making. By aligning with the findings of Susila et al. (2024), Scheyvens and Laeis (2022), Wondirad et al. (2021), Chatzitheodoridis and Kontogeorgos (2020), and Yi et al. (2024), this study contributes to the growing body of knowledge on sustainable procurement strategies in the hospitality industry.

The findings indicate that hotel managers generally perceive the economic feasibility of sourcing local agricultural products as a viable strategy for improving business efficiency and guest satisfaction. However, their procurement decisions are significantly influenced by concerns related to supplier reliability, cost stability, and regulatory support. While managers acknowledge the potential benefits of local sourcing, such as cost reduction through lower transportation expenses and enhanced guest experience due to fresh and authentic ingredients, they also highlight challenges such as seasonal availability, price fluctuations, and logistical constraints. Addressing these barriers through strategic supplier partnerships, flexible procurement models, and targeted policy incentives can enhance the feasibility and long-term sustainability of local procurement in the hospitality industry.

Conclusion

The study has demonstrated that procuring local agricultural products can be economically viable for small and medium-sized hotels, provided key factors such as supplier reliability, expected guest demand, perceived cost savings, and regulatory support are in place. The findings emphasize the importance of collaboration between the hospitality industry and local producers, which not only enhances business efficiency but also contributes to the development of local communities. The results suggest that strategic planning and the integration of local resources are crucial for strengthening

hotel competitiveness, serving as a model for other markets and sectors. This study provides a unique perspective on the economic sustainability of local procurement, integrating managerial, market, and regulatory aspects. The clearly presented findings make it accessible and useful not only to researchers and industry professionals but also to non-experts seeking practical guidelines for business improvement. The study contributes to global knowledge on tourism economics, offering direct benefits to students, researchers, and hotel managers. It is recommended for anyone interested in sustainable tourism strategies, as it enhances understanding and provides a foundation for improving practices in the hospitality sector.

Theoretical and practical implications

This research significantly contributes to both theory and practice in hotel management, particularly by analyzing the economic feasibility of local procurement. It expands existing theoretical knowledge on managerial decision-making by highlighting the importance of supplier reliability, guest demand, cost efficiency, and regulatory support. Unlike previous studies that have primarily focused on procurement strategies in large hotel chains or global markets, this study provides a unique contribution by addressing the specific challenges faced by small and medium-sized hotels in Serbia. By integrating economic, managerial, and regulatory aspects into an analytical framework, the research offers a nuanced understanding of how procurement strategies can be optimized in the hospitality sector.

From a practical perspective, the findings offer clear and actionable recommendations for hotel managers to enhance the feasibility of local sourcing. Establishing long-term partnerships with reliable local suppliers is essential to mitigating risks associated with seasonality and supply chain disruptions, ensuring a consistent and high-quality product supply. Additionally, flexible procurement strategies should be implemented to balance cost optimization with supply stability, particularly in response to potential price fluctuations and market volatility. Hotels can also leverage guest preferences for authentic and sustainable products by strategically incorporating local food offerings into their marketing and branding efforts, reinforcing consumer demand and strengthening customer loyalty.

While the benefits of local procurement are well-documented, this study also acknowledges the key barriers that may hinder its implementation. Supply chain disruptions, logistical constraints, and price volatility remain significant challenges for hotel managers seeking to integrate local products into their procurement strategies. To address these concerns, collaborative models such as cooperative purchasing agreements and regional supplier networks can help improve distribution efficiency and cost-effectiveness. Moreover, technology-driven solutions, including digital inventory management and predictive analytics, can assist in optimizing procurement decisions and mitigating potential risks associated with local sourcing.

Beyond hotel operations, the study emphasizes the role of policymakers in facilitating a more supportive regulatory and economic environment for local procurement. Policymakers should consider implementing targeted incentive programs, such as tax reliefs, financial subsidies, and investment in logistical infrastructure, to enhance the economic feasibility of sourcing local products. Additionally, the promotion of best practices from real-world case studies—such as government-backed farm-to-hotel initiatives or collaborative supply chain models—can provide industry stakeholders with concrete strategies for successful implementation.

These insights extend beyond Serbia, as the challenges and solutions discussed in this study are relevant to a wide range of tourism destinations where small and medium-sized hotels play a crucial role in the local economy. By offering an integrative approach that balances theoretical contributions with practical applications, this research provides valuable guidance for hotel managers, local producers, and policymakers seeking to enhance the sustainability and economic viability of local procurement in the hospitality industry.

Future research directions

Future research should focus on comparative studies across different regions and industries to assess the generalizability of the model. Additionally, longitudinal studies would provide deeper insights into the long-term economic benefits of local procurement. Particular attention should be given to the impact of product seasonality and the role of emerging technologies in procurement logistics. Further investigations could also explore guest perceptions of authenticity and quality in local products, as well as the environmental impact of local sourcing practices.

Limitations of the study

A key limitation of this study is its focus on the hotel industry in Serbia, which may restrict the generalizability of the findings on a global scale. Additionally, as the research is based on a cross-sectional study, it does not account for the long-term effects of local procurement on hotel performance. Furthermore, sample selection may influence the overall applicability of the results, as not all types of hotels or varied levels of guest preferences were included. Future research should address these limitations to further validate the economic feasibility of local procurement in the hospitality sector worldwide.

Conflict of interests

The authors declare no conflict of interest.

References

1. Achmad, W., & Yulianah, Y. (2022). Corporate social responsibility of the hospitality industry in realizing sustainable tourism development. *Enrichment: Journal of Management*, *12*(2), 1610-1616. https://doi.org/10.35335/enrichment.v12i2.447

2. Alrawabdeh, W. (2021). Seasonal balancing of revenue and demand in hotel industry: the case of Dubai City. *Journal of Revenue and Pricing Management*, *21*(1), 36. doi: 10.1057/s41272-021-00290-6

3. Ammirato, S., Felicetti, A. M., Raso, C., Pansera, B. A., & Violi, A. (2020). Agritourism and sustainability: What we can learn from a systematic literature review. *Sustainability*, *12*(22), 9575. https://doi.org/10.3390/su12229575

4. Baratta, R., & Simeoni, F. (2021). Food is good for you (and the planet): Balancing service quality and sustainability in hospitality. *Sinergie Italian Journal of Management*, *39*(1), 193-213.

5. Bardukova, L. (2023). Navigating the Hospitality Horizon: Current Trends and Strategies for Customer Attraction and Retention in the Hotel Industry. *Economics and computer science*, *2*, 88-103.

6. Beauducel, A., & Wittmann, W. W. (2005). Simulation Study on Fit Indexes in CFA Based on Data With Slightly Distorted Simple Structure . Structural Equation Modeling: A Multidisciplinary Journal, 12(1), 41–75. https://doi.org/10.1207/s15328007sem1201_3

7. Berti, G. (2020). Sustainable agri-food economies: Re-territorialising farming practices, markets, supply chains, and policies. *Agriculture*, *10*(3), 64. https://doi.org/10.3390/agriculture10030064

8. Bhattacharya, S., Sarkar, B., Sarkar, M., & Mukherjee, A. (2024). Hospitality for prime consumers and others under the retail management. *Journal of Retailing and Consumer Services*, *80*, 103849. https://doi.org/10.1016/j.jretconser.2024.103849

9. Canivez, G. L., McGill, R. J., Dombrowski, S. C., Watkins, M. W., Pritchard, A. E., & Jacobson, L. A. (2020). Construct validity of the WISC-V in clinical cases: Exploratory and confirmatory factor analyses of the 10 primary subtests. Assessment, 27(2), 274-296. https://doi.org/10.1177/1073191118811609

10. Ceynowa, W., Przybyłowski, A., Wojtasik, P., & Ciskowski, Ł. (2024). Digitalization and Sustainability of Supply Chains: Assessing the Potential of the DYLLI Application in the Hotel, Restaurant, and Catering Industry. *Sustainability*, *16*(23), 10380. https://doi.org/10.3390/su162310380

11. Chatzitheodoridis, F., & Kontogeorgos, A. (2020). Exploring of a small-scale tourism product under economic instability: The case of a Greek rural border area. *Economies*, *8*(3), 52. https://doi.org/10.3390/economies8030052

12. Chen, C. L. (2022). Strategic sustainable service design for creative-cultural hotels: A multi-level and multi-domain view. *Local Environment*, *27*(1), 46-79. https://doi.org/10.1080/13549839.2021.2001796

13. Cho, M., Bonn, M. A., Giunipero, L., & Jaggi, J. S. (2021). Supplier selection and partnerships: Effects upon restaurant operational and strategic benefits and performance. *International Journal of hospitality management*, *94*, 102781. https://doi.org/10.1016/j.ijhm.2020.102781

14. Chung, K. C. (2020). Green marketing orientation: Achieving sustainable development in green hotel management. *Journal of Hospitality Marketing & Management*, *29*(6), 722-738. https://doi.org/10.1080/19368623.2020.1693471

15. Ciulli, F., Kolk, A., & Boe-Lillegraven, S. (2020). Circularity brokers: Digital platform organizations and waste recovery in food supply chains. *Journal of Business Ethics*, *167*, 299-331. https://doi.org/10.1007/s10551-019-04160-5

16. Cvijanović, D., Ignjatijević, S., Vapa Tankosić, J., & Cvijanović, V. (2020). Do local food products contribute to sustainable economic development?. *Sustainability*, *12*(7), 2847. https://doi.org/10.3390/su12072847

17. Dalir, S. (2024). Innovative strategies to tackle seasonality issue in hospitality and tourism industry. *International Journal of Contemporary Hospitality Management*, *36*(5), 1690-1709. https://doi.org/10.1108/IJCHM-09-2023-1382

18. Das, I. R., Islam, A. S., & Talukder, M. B. (2024). Customer Satisfaction in Hospitality Marketing From a Technological Perspective. In *Impact of AI and Tech-Driven Solutions in Hospitality and Tourism* (pp. 383-407). IGI Global. DOI: 10.4018/979-8-3693-6755-1.ch019

19. Dyshkantiuk, O., Salamatina, S., Polishchuk, L., Komarnytskyi, I., Tserklevych, V., & Nedobiichuk, T. (2020). Modern hotel business management tools. *International Journal of Advanced Research in Engineering and Technology*, *11*(6).

20. Enzenbacher, D. J. (2020). Exploring the food tourism landscape and sustainable economic development goals in Dhofar Governorate, Oman: Maximising stakeholder benefits in the destination. *British Food Journal*, *122*(6), 1897-1918. https://doi.org/10.1108/BFJ-09-2018-0613

21. Floričić, T. (2020). Sustainable solutions in the hospitality industry and competitiveness context of "green hotels". *Civil Engineering Journal*, *6*(6), 1104-1113.

22. Gajić, T., Blešić, I., Petrović, M.D., Radovanović, M.M.. Đoković, F.. Demirović Bajrami, D.. Kovačić, S., Jošanov Vrgović, I., Tretyakova, T.N., & Syromiatnikova, J.A. (2023b). Stereotypes and Prejudices as (Non) Attractors for Willingness to Revisit Tourist-Spatial Hotspots in Serbia. Sustainability,15, 5130. https://doi.org/10.3390/su15065130

23. Gajić, T., Vukolić, D., Zrnić, M., & Dávid Lóránt Dénes (2023a). The quality of hotel service as a factor of achieving loyalty among visitors. *Hotel and Tourism Management, 11*(1)9, 67-77. https://doi.org/10.5937/menhottur2301067G

24. Ghafourian, M., Nika, C. E., Mousavi, A., Mino, E., Al-Salehi, M., & Katsou, E. (2022). Economic impact assessment indicators of circular economy in a decentralised circular water system—Case of eco-touristic facility. *Science of the Total Environment, 822*, 153602. https://doi.org/10.1016/j.scitotenv.2022.153602

25. Han, H. (2020). Theory of green purchase behavior (TGPB): A new theory for sustainable consumption of green hotel and green restaurant products. *Business strategy and the environment*, *29*(6), 2815-2828. https://doi.org/10.1002/bse.2545

26. Hussein, H., Albadry, O. M., Mathew, V., Al-Romeedy, B. S., Alsetoohy, O., Abou Kamar, M., & Khairy, H. A. (2024). Digital leadership and sustainable competitive advantage: leveraging green absorptive capability and eco-innovation in tourism and hospitality businesses. *Sustainability*, *16*(13), 5371. https://doi.org/10.3390/su16135371

27. Japutra, A., & Situmorang, R. (2021). The repercussions and challenges of COVID-19 in the hotel industry: Potential strategies from a case study of Indonesia. *International Journal of Hospitality Management*, *95*, 102890. https://doi.org/10.1016/j.ijhm.2021.102890

28. Khalil, N., Che Abdullah, S. N., Haron, S. N., & Hamid, M. Y. (2024). A review of green practices and initiatives from stakeholder's perspectives towards sustainable hotel operations and performance impact. *Journal of Facilities Management*, *22*(4), 653-682. https://doi.org/10.1108/JFM-03-2022-0025

29. Kim, J. J., & Han, H. (2022). Saving the hotel industry: Strategic response to the COVID-19 pandemic, hotel selection analysis, and customer retention. *International Journal of Hospitality Management*, *102*, 103163. https://doi.org/10.1016/j.ijhm.2022.103163

30. Kwiatkowski, G., Hjalager, A. M., Ossowska, L., Janiszewska, D., & Kurdyś-Kujawska, A. (2024). The entrepreneurial orientation of exhibitors and vendors at food festivals. *Journal of Policy Research in Tourism, Leisure and Events*, *16*(2), 207-226. https://doi.org/10.1080/19407963.2021.1999967

31. Le, S., Wu, J., & Zhong, J. (2021). Relationship quality and supply chain quality performance: The effect of supply chain integration in hotel industry. *Computational Intelligence*, *37*(3), 1388-1404. https://doi.org/10.1111/coin.12379

32. Li, Y., Liu, Y., & Solangi, Y. A. (2024). Analysis of factors and strategies for the implementation of sustainable tourism in a green economic structure in China. *Journal of Cleaner Production*, *434*, 140011. https://doi.org/10.1016/j.jclepro.2023.140011

33. Liu, W., & Li, J. (2024). Knowledge Dynamics in Rural Tourism Supply Chains: Challenges, Innovations, and Cross-Sector Applications. *Journal of the Knowledge Economy*, 1-33. https://doi.org/10.1007/s13132-024-01862-8

34. Marsh, H. W., Guo, J., Dicke, T., Parker, P. D., & Craven, R. G. (2019). Confirmatory Factor Analysis (CFA), Exploratory Structural Equation Modeling (ESEM), and Set-ESEM: Optimal Balance Between Goodness of Fit and Parsimony. Multivariate Behavioral Research, 55(1), 102–119. https://doi.org/10.1080/00273171.2019.1602503

35. Marusak, A., Sadeghiamirshahidi, N., Krejci, C. C., Mittal, A., Beckwith, S., Cantu, J., ... & Grimm, J. (2021). Resilient regional food supply chains and rethinking the way forward: Key takeaways from the COVID-19 pandemic. *Agricultural Systems*, *190*, 103101. https://doi.org/10.1016/j.agsy.2021.103101

36. Maynard, D. D. C., Vidigal, M. D., Farage, P., Zandonadi, R. P., Nakano, E. Y., & Botelho, R. B. A. (2020). Environmental, social and economic sustainability indicators applied to food services: A systematic review. *Sustainability*, *12*(5), 1804. https://doi.org/10.3390/su12051804

37. Mehrotra, S., & Jaladi, S. R. (2022). How start-ups in emerging economies embrace circular business models and contribute towards a circular economy. *Journal of Entrepreneurship in Emerging Economies*, *14*(5), 727-753. http://dx.doi.org/10.1108/JEEE-10-2021-0410

38. Meneguel, C. R. D. A., Hernández-Rojas, R. D., & Mateos, M. R. (2022). The synergy between food and agri-food suppliers, and the restaurant sector in the World Heritage City of Córdoba (Spain). *Journal of Ethnic Foods*, *9*(1), 11. https://doi.org/10.1186/s42779-022-00126-7

39. Mishra, R., Singh, R. K., & Subramanian, N. (2022). Impact of disruptions in agri-food supply chain due to COVID-19 pandemic: contextualised resilience framework to achieve operational excellence. *The International Journal of Logistics Management*, *33*(3), 926-954. https://doi.org/10.1108/IJLM-01-2021-0043

40. Mohammed, A., de Sousa Jabbour, A. B. L., Koh, L., Hubbard, N., Jabbour, C. J. C., & Al Ahmed, T. (2022). The sourcing decision-making process in the era of digitalization: A new quantitative methodology. *Transportation Research Part E: Logistics and Transportation Review*, *168*, 102948. https://doi.org/10.1016/j.tre.2022.102948

41. Obrenovic, B., Du, J., Godinic, D., Tsoy, D., Khan, M. A. S., & Jakhongirov, I. (2020). Sustaining enterprise operations and productivity during the COVID-19 pandemic:"Enterprise Effectiveness and Sustainability Model". *Sustainability*, *12*(15), 5981. https://doi.org/10.3390/su12155981

42. Okeke, N. I., Bakare, O. A., & Achumie, G. O. (2024). Forecasting financial stability in SMEs: A comprehensive analysis of strategic budgeting and revenue management. *Open Access Research Journal of Multidisciplinary Studies*, *8*(1), 139-149. https://doi.org/10.53022/oarjms.2024.8.1.0055

43. Omar, I. A., Hasan, H. R., Jayaraman, R., Salah, K., & Omar, M. (2024). Using blockchain technology to achieve sustainability in the hospitality industry by reducing food waste. *Computers & Industrial Engineering*, *197*, 110586. https://doi.org/10.1016/j.cie.2024.110586

44. Orynycz, O., & Tucki, K. (2021). Total productive maintenance approach to an increase of the energy efficiency of a hotel facility and mitigation of water consumption. *Energies*, *14*(6), 1706. https://doi.org/10.3390/en14061706

45. Panno, A. (2020). Performance measurement and management in small companies of the service sector; evidence from a sample of Italian hotels. *Measuring business excellence*, *24*(2), 133-160. https://doi.org/10.1108/MBE-01-2018-0004

46. Pantić, N., Cvijanović, D., & Imamović, N. (2021). Economic analysis of the factors influencing the supply and demand of raspberry. *Economics of Agriculture, 68*(4), 1077-1087. DOI 10.5937/ekoPolj2104077P

47. Pering, I. M. A. A. (2020). Kajian Analisis Jalur Dengan Structural Equation Modeling (Sem) Smart-Pls 3.0. Jurnal Ilmiah Satyagraha, 3(2), 28-48. http://dx.doi.org/10.47532/jis.v3i2.177

48. 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), 38. https://doi.org/10.3390/jrfm14010038

49. Prevolšek, D., Kukurin, Ž., & Golja, T. (2024). Collaborative Synergies for Elevated Destination Experiences: A Model of Cooperation between Hotel Companies, DMOs, and Local Stakeholders. *Organizacija*, *57*(1), 20-38.

50. Recuero-Virto, N., & Arróspide, C. V. (2024). Culinary destination enchantment: The strategic interplay of local gastronomy in regional tourism development. *International Journal of Gastronomy and Food Science*, *36*, 100931. https://doi.org/10.1016/j.ijgfs.2024.100931

51. Santa, R., Rodríguez Victoria, O. E., & Tegethoff, T. (2025). The role of quality in the hotel sector: the interplay between strategy, innovation and outsourcing to achieve performance. *The TQM Journal*, *37*(1), 199-221. https://doi.org/10.1108/TQM-01-2023-0016

52. Scheyvens, R., & Laeis, G. (2022). Linkages between tourist resorts, local food production and the sustainable development goals. In *Recentering Tourism Geographies in the 'Asian Century'* (pp. 139-161). Routledge.

53. Sigala, M. (2014). Customer involvement in sustainable supply chain management: A research framework and implications in tourism. *Cornell Hospitality Quarterly*, *55*(1), 76-88. https://doi.org/10.1177/1938965513504030

54. Stalmirska, A. M. (2024). Local food in tourism destination development: The supply-side perspectives. *Tourism Planning & Development*, *21*(2), 160-177. https://doi.org/10.1080/21568316.2021.1928739

55. Sürücü, L., Yıkılmaz, İ., & Maşlakçı, A. (2022). Exploratory factor analysis (EFA) in quantitative researches and practical considerations. Gümüşhane Üniversitesi Sağlık Bilimleri Dergisi, 13(2), 947-965. https://doi.org/10.37989/gumussagbil.1183271

56. Susila, I., Dean, D., Harismah, K., Priyono, K. D., Setyawan, A. A., & Maulana, H. (2024). Does interconnectivity matter? An integration model of agro-tourism development. *Asia Pacific Management Review, 29*(1), 104-114. https://doi.org/10.1016/j.apmrv.2023.08.003

57. Sutomo, S., & Mukhlis, I. (2023). Food And Beverage Business Innovation In Higher Education Environments: SWOT Analysis And Digital Literacy Empowerment. *Management Studies and Entrepreneurship Journal (MSEJ)*, *4*(6), 9534-9544. https://doi.org/10.37385/msej.v4i6.3830

58. Thomas-Francois, K., von Massow, M., & Joppe, M. (2017). Service-oriented, sustainable, local food value chain–A case study. *Annals of Tourism Research*, *65*, 83-96. https://doi.org/10.1016/j.annals.2017.05.008

59. Van Huy, L., & Thai Thinh, N. H. (2024). Ranking the hotel website service quality according to customer's perception: A case study of 4-star hotel. *Journal of Quality Assurance in Hospitality & Tourism*, *25*(1), 37-56. https://doi.org/10.1080/1528008X.2022.2100032

60. Vasilakakis, K., & Sdrali, D. (2023). Supplier selection criteria in the Greek hotel food and beverage divisions. *Journal of Hospitality and Tourism Insights*, *6*(2), 447-463. https://doi.org/10.1108/JHTI-07-2021-0169

61. Vukolić, D., Gajić, T., Petrović, M. D., Bugarčić, J., Spasojević, A., Veljović, S., ... & Petrović, T. (2023). Development of the concept of sustainable agro-tourism destinations—exploring the motivations of Serbian gastro-tourists. *Sustainability*, *15*(3), 2839. https://doi.org/10.3390/su15032839

62. Widaman, K. F., & Helm, J. L. (2023). Exploratory factor analysis and confirmatory factor analysis. In H. Cooper, M. N. Coutanche, L. M. McMullen, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), APA handbook of research methods in psychology: Data analysis and research publication (2nd ed., pp. 379–410). American Psychological Association. https://doi.org/10.1037/0000320-017

63. Wondirad, A., Kebete, Y., & Li, Y. (2021). Culinary tourism as a driver of regional economic development and socio-cultural revitalization: Evidence from Amhara National Regional State, Ethiopia. *Journal of Destination Marketing & Management, 19*, 100482. https://doi.org/10.1016/j.jdmm.2020.100482

64. Wong, M. H. (2022). Integrated sustainable waste management in densely populated cities: The case of Hong Kong. *Sustainable Horizons, 2*, 100014. https://doi.org/10.1016/j.horiz.2022.100014

65. Xia, B., Dong, S., Li, Z., Zhao, M., Sun, D., Zhang, W., & Li, Y. (2022). Eco-efficiency and its drivers in tourism sectors with respect to carbon emissions from the supply chain: An integrated EEIO and DEA approach. *International Journal of Environmental Research and Public Health*, *19*(11), 6951. https://doi.org/10.3390/ijerph19116951

66. Yacoub, L., & ElHajjar, S. (2021). How do hotels in developing countries manage the impact of COVID-19? The case of Lebanese hotels. *International Journal of Contemporary Hospitality Management*, *33*(3), 929-948. https://doi.org/10.1108/IJCHM-08-2020-0814

67. Yi, Y., Siow, M. L., Ibrahim, R., & Abdul Aziz, F. (2024). Understanding the role of tourist-oriented villages in promoting rural tourism in China: Integrating rural landscapes and tourist services. *Journal of Quality Assurance in Hospitality & Tourism*, 1-41. https://doi.org/10.1080/1528008x.2024.2401200

ECONOMIC EMPOWERMENT OF WOMEN IN RURAL AREAS

Olja Arsenijević[1], Maja Dimić[2]

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

ARTICLE INFO

Review Article

Received: *23 August 2024*

Accepted: *20 September 2024*

doi:10.59267/ekoPolj2501315A

UDC 347.156-055.2:911.373

Keywords:

Gender equality, rural environment, Republic of Serbia, networking, knowledge management

***JEL**: L26*

ABSTRACT

Gender equality is a problem that not only affects the Republic of Serbia but also causes significant and challenging issues in the developed world. In rural areas, the problem of gender equality is even more pronounced, given the fact that women are working auxiliary unpaid jobs, that they are economically dependent, and, in a large percentage, low educated. The paper aims to point out the problems of gender equality in rural areas in the Republic of Serbia to offer ideas and possible solutions to some segments of this problem. The paper analyses the Republic of Serbia's strategies for gender equality in general and rural areas and mentions legislation in this area in the Republic of Serbia. The authors conducted a comparative analysis of women's entrepreneurship in selected EU countries and gave communication and knowledge management strategies for women's empowerment in rural areas.

Introduction

With its Constitution, laws, and the adoption of international standards, the Republic of Serbia has committed itself to introducing a gender perspective in all policies and levels.

However, the gender equality index, according to Babovic (2016), says the opposite. There are inequalities between women and men in all areas, including health, work, power, knowledge, money, and time. The most considerable disparity lies in the domain of money and labour. Also, when analysing employment policy, the lack of a gender perspective can be observed, both in analysing the situation in the labour market and in measures for improving the problem that should affect the systemic and structural causes of gender inequality in the Serbian labour market. (Pantović et al., 2017).

1 Olja Arsenijević, Full professor, Institut for serbian culture Pristina – Leposavic, 24. novembra bb, 38218 Leposavic, Serbia, Phone: +381606689698, E-mail: arsenijevicolja@gmail.com, ORCID ID (https://orcid.org/0000-0002-0465-0508)

2 Maja Dimić, Associate professor, Faculty of business studies and law, Jurija Gagarina 149a, 11000 Belgrade, Serbia, Phone: +381638585455, E-mail maja.dimic@fpsp.edu.rs, ORCID ID (https://orcid.org/0000-0002-9218-6687)

The biggest problem is the position of women in the countryside. The Committee on the Elimination of Discrimination against Women discusses this issue in its Concluding Observations. "There are inequalities between women in the city and women in the countryside in the member state regarding living standards and employment, especially older women. Therefore, Serbia must provide rural women, including older women, with unhindered access to adequate living standards and employment." (Janković et al. 2016; Committee on the Elimination of Discrimination against Women, 2017).

Inequality is also observed in the total rural population in the Republic of Serbia. The 2020 Eurostat Income and Living Conditions Survey points to the fact that the population in the villages of Serbia is at greater risk of poverty and social exclusion than the population in the cities. "The rate of risk of poverty and social exclusion is 46.8% in rural areas and 32.7% in urban areas". The gender gap in the labour market is more pronounced in other settlements than in the city. Although the difference in labour market indicators between men and women has the same direction in both settlements, the gender gap is more pronounced in rural settlements (the male unemployment rate is lower). The labour force survey from 2017 points to large differences between the city and the village: "The gap in employment rates in other settlements is 19.4%, while it is 11% in urban settlements." (Eurostat, 2020)

Regarding the quality of employment, the data are truly devastating. Namely, almost 50% of women in rural areas are in vulnerable employment.

According to Bradaš et al. (2018): "Women in the countryside do not have working hours, they are mostly engaged in unpaid domestic work, taking care of children and the elderly is exclusively theirs. In addition, most of them are engaged in agricultural work."

Women face more significant difficulties than men in accessing public services, social protection, employment opportunities and the local and national labour market, both due to cultural norms and security issues. Unpaid work that involves caring for children, the sick and the elderly further hinders the ability of rural women to take advantage of off-farm employment and market opportunities in the agricultural sector.

UN Women, FAO, IFAD and WFP agreed to provide a comprehensive response to the UN system to support rural women's economic empowerment through joint actions. Each agency has a comparative advantage for this work: FAO's professional and technical knowledge, policy assistance in agriculture and food security, and IFAD co-finances rural investment programs and has an intensive presence in rural areas. WFP helps in food production with its technical knowledge, and UN Women provides its expertise and knowledge in women's economic empowerment through its connection with women's movements and the fight for gender equality and women's empowerment within the system (UN Women, 2013).

In the second phase of UN Women's Empowerment, the Republic of Serbia joined with various programs.

Materials and methods

The paper used descriptive and content analysis methods, by which the authors analysed strategic documents on women's gender equality in the Republic of Serbia, with reference to women in rural areas. Also, these methods were used for comparative analysis of women entrepreneurship in rural areas of selected European Union countries, as well as for the presentation of financial assistance in the form of grants, which women entrepreneurs operating on the territory of the Republic of Serbia can receive at different stages of business development. A particular focus was placed on empowering women entrepreneurs in rural areas.

Results and discussions

Comparative analysis of female rural entrepreneurship in selected EU countries

According to research EURuraliTeast young and middle-aged rural women are well-educated. This is important for accepting new challenges and reflects a positive attitude towards entrepreneurship. The advantages of rural women in the labour market include education, qualifications, professional experience, ability to work in a team, creativity, resistance to stress, good work organisation, sense of responsibility, discipline and concentration when performing tasks.

Poland

Poland is characterised by a very high rate of women's self-employment (every seventh woman was self-employed in 2010). According to Eurostat data, Polish women occupy fifth place in Europe, behind Greek, Italian, Croatian and Portuguese women.

The village is an area that contributes to the development of entrepreneurship. In this context, a slight advantage of men over women can be observed, as almost 8% more men run their businesses than women (22.1%, primarily self-employed). Rural women in Poland have a positive attitude towards professional activism and can appreciate its benefits. Statistics show that they aspire to employment outside of agriculture. Many would like to start their own company rather than engage in agricultural work. Professional aspirations are mainly influenced by age, farm size, marital status or the woman's general condition on the farm. In the research of the Ministry of Agriculture and Rural Development, the following patterns were described 2012 (Banski, Mazur, 2016). The older a woman is, the more often her aspirations are related to agricultural activity, while for younger women, their aspirations are often not related to agriculture.

- The larger the agricultural holding, the more complex the aspirations of women related to agricultural activity;
- Aspirations not related to agriculture are more often noticeable in unmarried women, more often divorced;
- Non-agricultural endeavours are more common among non-agricultural women.

The main factors that support implementing measures related to multifunctional agriculture and cultural heritage are various projects and programs related to exploiting the potential of villages (REWARD, 2018). At the national level, the Responsible Development Strategy was adopted in 2017. It is a crucial document in medium and long-term economic policy. Many strategic programs were defined within its framework. The following projects are crucial in terms of increasing rural women's activity:

- Family policy and childcare - complex and systematic support for families with children, which, among other things, includes the systematic provision of institutional care for young children (up to 3 years old) and enables parents and guardians to return to work, as well as a program to increase the number of places for preschool education to improve the quality of education.
- New opportunities for the villages - a program for the professional activation of farmers and persons related to agriculture for the needs of the non-agricultural labour market, considering funding instruments from cohesion policy funds, the Rural Development Program 2014-2020, and national measures for the functioning of the labour market.
- Business packages - a new set of legal acts that comprehensively regulates the principles of conducting business activities in Poland, creates favourable, transparent, and stable business conditions, provides legal security, reduces business risk, and increases the willingness of entrepreneurs to take the technological risk associated with the implementation of innovative projects.

Slovenia

According to research conducted by TERA (Šterban et. al 2022), women are the most burdened with work in the countryside, as many as 47% of them, compared to men, 16%. One-quarter of rural women live without rest. The research showed that women most often do gardening and care for small animals, while the jobs of keeping documentation, marketing, and economics are primarily assigned to men. What is positive in the research is that decisions are made jointly, confirmed by 52% of respondents.

Research conducted in 2022 by the Union of Agricultural Women and the Ministry of Labour, Family, Social Affairs and Equal Opportunities on the position of women in rural areas of Slovenia shows the following (FAO, 2022):

- Most female agriculturists are tired and have little free time;
- 35% of them have no personal income;
- 9% do not have their bank account;
- 15% of women employed in the agricultural sector earn less than men;
- 20% of women manage agricultural holdings; that percentage is 28% in Europe (Šterban et al., 2022).

The research mentioned above showed that many rural women do not have social or health insurance.

Based on these two mentioned researches and similar ones conducted in the TERA project, Slovenia is working intensively on empowering women for entrepreneurship in rural areas. Three key lines are used for conducting education:

1. Gender stereotypes and gender roles of men and women in the countryside;
2. Harmonization of professional and personal life and gender equality;
3. Challenges and obstacles when seeking a balance between professional and personal life in the countryside - how to proceed and live differently (Šterban et al. 2022).

Within the Ministry of Labour, Family, Social Affairs and Equal Opportunities, the Equality sector shapes the equality policy between women and men, prepares proposals for regulations and measures to improve women's and men's positions and to eliminate discrimination based on gender. In addition, it provides expert support to ministries and local communities in incorporating the aspect of equality between women and men in policies and measures. It prepares a national program for the equality of women and men, analyses, and reports, conducts information campaigns, and cooperates with the EU, international organisations, and civil society. At the systemic level, it coordinates the tasks of ministries and government offices following the Protection Against Discrimination Act (Črnčič, 2016).

Active employment policy measures implemented in Slovenia do not differ by gender. The Strategy for Smart, Sustainable and Inclusive Growth EUROPE 2020, the 2010 Report of the European Commission, states that the employment rate of people aged 20 to 64 should increase from the current 69% to at least 75%, including increased inclusion of women and older workers and more effective inclusion of migrants in the labour market. The measures for implementing the strategy are (Banski &Mazur,2016):

1. Formal and informal training and education,
2. Workplace replacement and workplace sharing,
3. Employment incentives are primarily intended to employ unemployed persons from vulnerable groups.
4. Job creation is intended to encourage employment and social inclusion and to improve the expertise and work skills of the most vulnerable groups of unemployed persons.
5. Encouraging self-employment and supporting female entrepreneurship. Support for entrepreneurship implemented in Slovenia does not differ by gender. The Slovenian Entrepreneurial Fund is a public financial institution of the Republic of Slovenia, established to provide financial support and incentives to the entrepreneurial sector in Slovenia. It is also a co-founder of Slovenia's start-up ecosystem to achieve start-up companies' global success. (Perko, 2016).

Czech Republic

Women often start their entrepreneurial journey between the ages of 30 and 35. Many of them work in the business or trade sector. The percentage of women in the business sector in the Czech Republic is approximately 30%. However, that percentage also includes women who work for one employer as self-employed (the so-called Schwarz system). On the other hand, that percentage does not include women who work with their husbands in a family business, where the husband and wife are usually listed as entrepreneurs and owners. More than support for developing entrepreneurship in the Czech Republic is required (Mendel University, 2024). To create economic growth, taxes should be lowered because minimum taxes are high (above 30%), and high social security contributions cause many entrepreneurs to cease their activities, resulting in job losses for employees. Paradoxically, female entrepreneurs in the Czech Republic do not have the right to social benefits for the care of their sick children, and they also have worse access to increasingly limited kindergartens. Helping families (from nannies to kindergartens) is still not recognised as a tax benefit in the Czech Republic, and state measures do not encourage the creation of shorter-time jobs. The state also does not support establishing daycare facilities in the workplace. These deficiencies, along with high taxation and current poor social and health insurance adjustments, should be corrected in the future to improve the general position of women and provide more opportunities for them (Haubertova, 2011; REWARD, 2018).

Considering the situation in the labour market, where the percentage of unemployed women is higher than men, 40% of women were included in the Start program and received 37% of initial funds for starting a business. Female business owners received only 11% of funds from other business support programs. The Ministry of Industry and Trade in the Czech Republic supports some minor activities of non-profit organisations supporting female entrepreneurship, such as the Association of Entrepreneurs and Managers of the Czech Republic or the Association of Entrepreneurs in the Central Bohemian Region and Moravia. The Association of Women Entrepreneurs and Managers of the Czech Republic is a leading partner in the project "European Entrepreneur of the 21st Century" within the EQUAL Program, which aims to support the entrepreneurship of women, especially those disadvantaged in the labour market, in regions with a high unemployment rate in the northern Czech Republic (Bohemia) (European Commission, 2012).

Strategic documents on gender equality of women in the Republic of Serbia with particular reference to women in rural areas

The Republic of Serbia has developed a strategy for gender equality for the period 2021-2030 (Official Gazette of the Republic of Serbia, No. 103/21). This Strategy bases on planning documents, among others, on the Agriculture and Rural Development Strategy of the Republic of Serbia 2014-2024 (Official Gazette of the Republic of Serbia, No. 47/19), the Law on Agriculture and Rural Development (Official Gazette of the Republic of Serbia, No. 41/09 and 101/16), the Law on Incentives for Agriculture and Rural

Development (Official Gazette of the Republic of Serbia, No.10/13, 142/14, 103/15, 101/16). The previous Strategy for 2018-2020 could not pass the evaluation because the Action Plan for 2018-2020 was not adopted. Nevertheless, the state continued to implement measures aimed at gender-responsive budgeting, improving the position of women in rural areas. "This particularly refers to measures to encourage agriculture aimed at women, measures to support organic crop and livestock production, measures for active employment of women in rural areas, training for the application of IT for women entrepreneurs in rural areas, innovative social inclusion programs in rural areas, improvement of property situation of women in the countryside." (Evaluation of the Strategy for Gender Equality, objective 3.1.)

Since training for the application of IT for women entrepreneurs in rural areas is also planned among the measures, the Strategy for the Development of Digital Skills in the Republic of Serbia for the period 2020 - 2024 (Official Gazette of the Republic of Serbia, No. 21/2020, 8/2023-12) plans activities for affirmation of the field of ICT for women from rural areas and other vulnerable groups. This may seem unusual, but official statistics in the Republic of Serbia show that the representation of computers in the urban part is 73.3%. In rural areas, it is significantly lower and amounts to 54% (Statistical Office of the Republic of Serbia, 2022).

When it comes to the empowerment of women in the ICT sector, it is essential to note that in 2017, the Ministry of Trade, Tourism and Telecommunications, with the support of UNESCO, implemented the project "Retraining and additional training of women in the field of ICT", to reduce the gap between women and men, as well as project "Training for women in the field of IT". In 2018, 350 women from rural Serbia passed the digital literacy project for women from rural areas. In addition to digital literacy and developing digital skills, this project also included the digital promotion of traditional domestic products. It was all done in cooperation with different women's associations (The Program for Empowering Women in the Field of Information and Communication Technologies for the Period 2019-2020 "Official Gazette of the RS", no. 18/2019).

The Strategy mentioned above envisages the construction of a broadband communication infrastructure throughout Serbia's territory. Therefore, it is crucial to implement training and the use of ICT (Official Gazette of the Republic of Serbia, No. 21/2020, 8/2023-12).

The economic position of women in rural areas in Serbia is unfavourable. "The unfavourable economic position of women in rural areas, which is reflected in lower chances for sustainable employment, in addition to lower ownership of private resources, such as land, arable land and real estate, is also affected by inadequate access to community services that would increase their chances in the labour market (services of care and care for children, sick and elderly), transport, access to information on rights and available forms of support, access to Information Technologies, access to knowledge and lifelong learning programs that would create chances for sustainable employment, self-employment, entrepreneurship and social entrepreneurship."(Official Gazette of the Republic of Serbia, No. 103/21; section 5.1.1.6.) Also, the support

available to rural women is insufficient; it should be systematically addressed to improve their quality of life.

Another major problem for women in rural areas is health care. The Commissioner for the Protection of Equality states in his report that women in rural areas are discriminated against in comparison to others because health care is unavailable to them due to the closure of health clinics, they do not have a home care service, and integrated services at the local level undeveloped (The Commissioner for the Protection of Equality, 2021).

Programs for the economic empowerment of women's entrepreneurship in the Republic of Serbia

The women's entrepreneurship sector in the Republic of Serbia is considered increasingly crucial yearly. Following this, numerous national and international financial and non-financial support programs aimed at businesswomen in Serbia are formed and implemented (Chamber of Commerce and Industry of Serbia, 2022: 21). The report Women Entrepreneurship in Serbia: 10 years later states that the total number of active entrepreneurs has increased from 221,541 in 2011 to 290,387 in 2022. The participation of women's businesses in total entrepreneurship increased from 28.1% to 31.2%. (UN Women, SeCons, 2023: 23).

In March 2018, under the auspices of the National Assembly of Serbia, the mentioned campaign aimed at women's economic empowerment through women's innovative entrepreneurship, empowerment of women in the fight against domestic violence, and encouraging women to participate in preventive health examinations. (National Assembly of Serbia, Campaign Women Live in Rural Areas, 2024). Within the mentioned program, eight villages on the territory of the Republic of Serbia are organised forums with participants: rural women who stand out with innovative ideas and support the development of women's entrepreneurship in rural areas, representatives of organisations and associations dealing with the empowerment of women's entrepreneurship and protection of women's labour rights, doctors, representatives of municipalities involved in the implementation of the project.

As stated in the Analysis of the Women's Entrepreneurship Sector of the Serbian Chamber of Commerce in 2022, the critical area for the development of the sector of women's entrepreneurship, which forms the backbone of the Serbian economy, is the creation of a "various offer of financial instruments and sources of financing for micro, small, medium-sized enterprises and entrepreneurs, to establish a stimulating business environment" (Chamber of Commerce and Industry of Serbia, Women's Entrepreneurship Sector in Serbia, 2022:21). In this regard, compared to the countries of the European Union where the cult of female entrepreneurship has developed, the sources of financing in the Republic of Serbia are less favourable, especially for women who live and grow businesses in rural areas of the country.

Data from the Serbian Chamber of Commerce from 2022 indicate that out of 153 female entrepreneurs surveyed, as many as 95 businesswomen never applied for

support programs, which makes up 62% of the total number of respondents, while 38% of the surveyed businesswomen used available business support programs. Incentive state funds were allocated to businesswomen through institutions such as Ministry of Economy (5.9%), Development Fund (6.5%), Development Agency of Serbia (5.2%), Ministry of Agriculture, Forestry and Water Management (3.9%), Ministry of Labour, Employment, Veteran and Social Policy (4.6%), National Employment Service (20.9%), Local Self-Government (6.5%) (Chamber of Commerce and Industry of Serbia, Women's Entrepreneurship Sector in Serbia, 2022: 24-26).

When it comes to measures that encourage the development of entrepreneurship and strengthen the potential of female entrepreneurship, several different forms of state aid have been defined at the state level: support measures at the very beginning of the business, support for the growth and development of companies, and specially developed programs (support measures) related to those entrepreneurs who deal with the development of innovations, digitization and the development of the green economy (UN Women, SeCons, 2023: 18). In the phase of starting a business, women are the most discriminated against, and the fact that state support programs are less demanding and very accessible is very encouraging because they give women a specific advantage. After all, when assessing the fulfilment of conditions, women are treated as a vulnerable group (Popović Pantić, 2014: 159.) Within the first group of incentives support measures at the beginning of business, the State Government of the Republic of Serbia encourages women entrepreneurs. It provides a package of grants aimed at strengthening female entrepreneurship.

In 2021, Serbia launched a program to support women and young entrepreneurs with financial aid, including non-refundable funds and favorable loans from the Development Fund. The funds were used for equipment, delivery vehicles, business space maintenance, and operational costs (UN Women, SeCons, 2023: 17).

In 2022, the Ministry of Economy allocated 27.2 million dinars for grants, separating calls for youth and female entrepreneurs. Women entrepreneurs had access to up to RSD 600 million in non-refundable funds, with amounts ranging from RSD 400,000 to RSD 6 million. Additional funding could be obtained through loans with favorable terms from the Development Fund (Ministry of Economy, 2023).

In 2023, the EU PRO Plus program, in collaboration with the Ministry of European Integration, supported 45 women and young entrepreneurs in Serbia's less-developed municipalities with 375,000 euros. This funding aimed to enhance equipment, improve product quality, introduce innovations, and market positioning. The call targeted unemployed women and young people aged 18 to 30 in 43 underdeveloped municipalities, with nine info-sessions attended by over 170 participants (EU PRO Plus, 2023).

Communication strategies and knowledge management strategies as a prerequisite for women's empowerment in rural areas

Research confirms the importance of societies as generators and indicators of social capital in the countryside, which is attributed to the power to promote the neo-endogenous development of the countryside but also sheds light on the differences in the social engagement of the population. This most often refers to geographical and historical factors, political changes, reduction of economic capital, gender equality, proximity to the border and adverse demography. (Rac, et al., 2022).

Communication and knowledge management strategies are vital components for empowering women in rural areas of Serbia. It is necessary to determine and develop guidelines and branding tools, both locally and nationally. Creating and implementing a communication strategy would enable the provision of conditions for disseminating knowledge and learning, both internally and externally. Also, it would contribute to the dialogue on policies and good practices, enable the visibility of problems, and promote reasonable solutions. At the same time, it would enable the mobilization of more resources.

Effective communication for women in rural areas should be both oral and written, involving newsletters, online platforms, policy reports, and local contact points. A dedicated platform would facilitate information exchange, resource sharing, and mutual support across rural communities. Networking is essential for improving communication and knowledge management, as it connects women to their communities and supports local development. While social capital enhances community performance, declining inter-neighborly assistance due to emigration and modernization impacts women's independence and working conditions. Initiatives like driving license programs and digital literacy training are crucial for boosting mobility and economic independence for women in rural areas.

Conclusion

The United Nations General Assembly declared October 15 the International Day of Rural Women in 2008 (United Nations, 2024). This day is celebrated under the slogan, "Rural Women Cultivating Good Food for All". By marking this day, the UN wanted to highlight "the key role and contribution of women in the countryside for the improvement of agriculture and rural development, contribution to food sovereignty and eradication of poverty in rural areas".

Rural women represent the auxiliary labour force on family farms. Statistics indicate that among women who had the experience of inheriting property, more than half did not inherit anything, while in 60% of cases, the majority were inherited by male heirs. What is symptomatic is the fact that the most significant number of women renounce their inheritance in favour of their male relatives, which indicates their low awareness of their importance and contribution to the family, the village, and the immediate and broader social community, which supports our idea of the need to create communication and knowledge management strategies (Behram, Stein, 2023).

Statistical data from the Statistical Office of the Republic of Serbia (2023) show that only 19% of women in Serbia own agricultural land, and more than one-third are involved in food production and other related services.

A significant number of women in rural areas face economic hardships and struggle with accessing maternity benefits and pensions due to living in less developed regions. Improving their quality of life, reducing poverty, ensuring fair income distribution, and enhancing their social position are crucial for sustainable rural development in Serbia (Janković, 2021)

Acknowledgment

The article was created as a result of research work at the Institute for Serbian Culture, Priština-Leposavić, within the framework of the agreement concluded with the Ministry of Science, Technological Development and Innovation of the Republic of Serbia No. 451-03-66/2024-03 dated 26.01.2024. The research presented in this paper was funded by the Ministry of Science, Technological Development, and Innovation of the Republic of Serbia under contract number 51-03-66/2024-03 dated 26 January 2024.

Conflict of interests

The authors declare no conflict of interest.

References

1. Babović, M., (2016). Indeks rodne ravnopravnosti u Republici Srbiji – Merenje rodne ravnopravnosti u Srbiji 2014, Tim za socijalno uključivanje i smanjenje siromaštva Vlade Republike Srbije, Beograd [*in English:* Gender Equality Index in the Republic of Serbia – Measuring Gender Equality in Serbia 2014. Social Inclusion and Poverty Reduction Team of the Government of the Republic of Serbia, Belgrade]
2. Banski, J., Mazur, M., (2016) Classificaton of rural areas in Poland as an instrument of territorial policy. *Land Use Policy,* Vol. 54, pp. 1-17.
3. Behrman, J. A., Stein, D. (2023). Property rights and gender: Evidence from land titling programs. *Development Policy Review, 41*(4), e12609. https://doi.org/10.1111/dpr.12609
4. Bradaš, S., Petrovar, K. & Savić, G., (2018). Žene na selu – od nevidljivosti do razvojnog potencijala. Friedrich Ebert Stiftung, Beograd [*In English*: Women in Rural Areas – From Invisibility to Development Potential. Friedrich Ebert Stiftung, Belgrade]
5. Campaign Women Live in Rural Areas, Retrieved from: http://zeneziveinaselu.rs/, (11. 2. 2024.)
6. CEDAW komitet (2021). Četvrti periodični izveštaj za R. Srbiju [*in English*: Fourth Periodic Report for the Republic of Serbia]. Retrieved from: https://www.minljmpdd.gov.rs/medjunarodni-ugovori-konvencija-CEDAW.php, (13. 2. 2024.)

7. CEDAW komitet (2017). Uputstvo za pisanje izveštaja [*in English:* Report Writing Guidelines]. Retrieved from: https://www.womenngo.org.rs/images/CEDAW/uputstvozapisanjecedawizvestaja.pdf, (12. 2. 2024.)
8. Črnčič, L., (2016). Ženske v kmečkih gospodinjstvih v Sloveniji, Filozofska fakulteta, Maribor [*in English:* Women in Farm Households in Slovenia, Faculty of Art, Maribor]
9. Department Strategii Razwoju (2017). Strategia na rzecz Odpowiedzialnego Rozwoju do roku 2020 (z perspektywą do 2030 r.). Ministerstwo Razwoju, Varšava [*in English:* Department of Development Strategy (2017). Strategy for Responsible Development until 2020 (with a perspective until 2030). Ministry of Development, Warsaw]
10. European Commission (2012). European Network to Promote Women's Entrepreneurship (WES), Activity Report 2009-2010, Retrieved from: https://ec.europa.eu/docsroom/documents/10386/attachments/1/translations/en/renditions/native, (8.2.2024.)
11. EU PRO Plus (2023). Retrieved from https://eumogucnosti.rs/eu-podrska-za-45-zena-i-mladih-pocetnika-u-poslovanju/, (13. 2. 2024.)
12. Eurostat (2020). Inquome quintile share ratio S80/20 for disposable income by sex and age group – EU-SILC survey. (16.2. 2024.)
13. EU PRO Plus (2023). EU Support for 45 Women and Young Entrepreneurs Starting a Business, Retrieved from: https://eumogucnosti.rs/eu-podrska-za-45-zena-i-mladih-pocetnika-u-poslovanju/ (9.2.2024.)
14. EU RuraliTeast, Erazmus+ project - 101131496, (2024). https://ruraliteast.eu/results/
15. FAO. (2022) *Tracking progress on food and agriculture-related SDG indicators 2022*. Rome. https://doi.org/10.4060/cc1403en
16. Haubertova, E., (2011). Analýza a srovnání specifik venkovské krajiny v rámci vybraných zemí EU, Mendel University, Brno. *[in English*: Analysis and Comparison of the Specifics of Rural Landscapes in Selected EU Countries, Mendel University, Brno]
17. Janković, B., (2021). Govor na obeležavanju Međunarodnog dana žena sa sela, *Vrnjačke novine*, Vrnjačka Banja [*in English:* Speech at the Commemoration of International Day of Rural Women, Vrnjačke Novine, Vrnjačka Banja]
18. Janković, B., Zajić, G., Vračević, M. & Todorović, N., (2016). Položaj starijih na selu, Crveni krst Srbije, Beograd [*in English*: Janković, B., Zajić, G., Vračević, M. & Todorović, N. (2016). The Position of the Elderly in Rural Areas, Red Cross of Serbia, Belgrade]
19. Komitet za eliminaciju diskriminacije žena (2017). Opšte preporuke za ukidanje svih oblika diskriminacije žena [*in English:* Committee on the Elimination of Discrimination Against Women (2017) General Recommendations for the Elimination of All Forms of Discrimination Against Women] Retrieved from: https://rodnaravnopravnost.gov.rs/sites/default/files/2017-02/Op%C5%A1te-preporuke-Komiteta-za-ukidanje-svih-oblika-diskriminacije-%C5%BEena.pdf, (5. 2. 2024.)

20. Konsorcjum Badawcze FOCUS GROUP (2012). Raport z badania "Sytuacja kobiet w rolnictwie i na obszarach wiejskich. Specyfika, standardy, parytety i oczekiwania". Centrum Rozwoju Społeczno- Gospodarczego Sp. z o.o., Szczecin [*in English:* Research Consortium FOCUS GROUP (2012) Report on the Study 'The Situation of Women in Agriculture and Rural Areas: Specifics, Standards, Parity, and Expectations.' Social and Economic Development Center Ltd., Szczecin]
21. Law on Agriculture and Rural Development, Official Gazette of the RS 41/09 and other laws and 101/16. Belgrade
22. Law on Incentives for Agriculture and Rural Development, Official Gazette of the RS 10/13, 142/14, 103/15, 101/16. Belgrade.
23. Ministry of Economy (2023). Public Call for the Allocation of Non-Refundable Funds within the Entrepreneurship Development Program through Financial Support for Women's Entrepreneurship in 2022/ Support Program for Women Entrepreneurs and Youth in 2022
24. National Assembly of Serbia, Campaign Women Live in Rural Areas (2024).
25. Public Call for Grant Allocation within the Entrepreneurship Development Support Program, Retrieved from: https://privreda.gov.rs/usluge/javni-pozivi/javni-poziv-za-dodelu bespovratnih-sredstava-u-okviru-programa-podsticanja-razvoja-preduzetnistva. (14. 2. 2024.)
26. Pantović, J., Bradaš, S. & Petovar, K., (2017). Položaj žena na tržitu rada, Friedrich Ebert Stiftung, Beograd [*in English:* Pantović, J., Bradaš, S. & Petovar, K., (2017). Position of Women in the Labor Market, Friedrich Ebert Stiftung, Belgrade]
27. Perko, D. (2016). The Role of Public Institutions in Supporting Female Entrepreneurship in Slovenia. Slovenian Journal of Business Studies, 14(2), p. 112-130.
28. Podpora podnikání žen v zemědělské produkci v regionu [*in English:* Support for Women's Entrepreneurship in Agricultural Production in the Region], Mendel University in Brno, Retrieved from: https://mendelu.cz/en/the-research-team-from-mendelu-will-analyze-the-role-of-women-in-rural-life/, (28. 1. 2024.)
29. Popović Pantić S., (2014) Žensko preduzetništvo u Srbiji: Evolucija od socijalne ka ekonomskoj kategoriji, *Poslovna ekonomija*, godina VIII, broj II, str. 159 [*in English:* Women's Entrepreneurship in Serbia: Evolution from Social to Economic Category, Business Economics, Volume VIII, Issue II, p. 159] Retrieved from: https://scindeks-clanci.ceon.rs/data/pdf/1820-6859/2014/1820-68591402143P.pdf [3.2.2024.]
30. Privredna komora Srbije (2022). Sektor ženskog preduzetništva u Srbiji – Analiza [*in English:* Chamber of Commerce and Industry of Serbia (2022) The Sector of Women's Entrepreneurship in Serbia – Analysis] Retrieved from:https://api.pks.rs/storage/assets/Sektor%20zenskog%20preduzetnistva%20u%20Srbiji%20-%20Analiza.pdf, (21. 2. 2024.)

31. Rac, I., Černič Istenič M. & Erjavec, E., (2022). Socialna vprašanja na podeželju: stališče. Univerzitet u Ljubljani, Ljubljana [*in English:* Rac, I., Černič Istenič M. & Erjavec, E., (2022) Social Issues in Rural Areas: Perspectives. University of Ljubljana, Ljubljana]
32. Regulation on Supplementary Agricultural Activities, Official Gazette of the RS, No. 57/15 and 36/18, and Agricultural Act, Official Gazette of the RS, No. 45/08, 57/12, 90/12 – ZDZPVHVVR, 26/14, 32/15, 27/17 and 22/18. Ljubljana.
33. Reward (2018). REal World Advanced Technologies foR Diesel Engines, Retrieved from https://cordis.europa.eu/project/id/636380/reporting (18.2.2024.)
34. Strategy for Agriculture and Rural Development of the Republic of Serbia 2014 – 2024. Official Gazette of the RS 47/19. Belgrade
35. Strategy for the Development of Digital Skills in the Republic of Serbia for the Period 2020 – 2024. Official Gazette of the RS 21/2020, 8/2023-12. Belgrade.
36. Strategy for Gender Equality of the Republic of Serbia for the Period 2021 – 2030. Official Gazette of the RS 103/21. Belgrade
37. Statistical Office of the Republic of Serbia (2023), Agriculture list, Retrieved from: https://popispoljoprivrede.stat.gov.rs/media/31092/brosura-srpski-sa-koricom.pdf (13.2.2024.)
38. Šterban, Bezjak, N., Klavž, D. & Pavlič, A., (2022). Stanje enakosti spolov na podeležju, Raziskava TERA [*in English:* Šterban, Bezjak, N., Klavž, D. & Pavlič, A., (2022) Gender Equality Status in Rural Areas, TERA Research] Retrieved from: https://projekt-tera.si/dejstvaraziskav/, (12. 2. 2024.)
39. The Commissioner for the Protection of Equality (2021). Regular Annual Report of the Commissioner for Protection of Equality for 2021, Retrieved from: https://ravnopravnost.gov.rs/en/reports/, (10.2.2024.)
40. The Program for Empowering Women in the Field of Information and Communication Technologies for the Period 2019-2020 ("Official Gazette of the RS", no. 18/2019), Retrieved from: http://demo.paragraf.rs/demo/combined/Old/t/t2019_03/t03_0350.htm, (9.2.2024.)
41. United Nations (2008). Improvement of the situation of women in rural areas, Retrieved from: https://docs.un.org/en/A/RES/62/136, (11.2.2024.)
42. UN Women (2013). Corporate Evaluation of UN Women's Contribution to Increasing Women's Leadership and Participation in Peace and Security and Humanitarian Response, UN, New York
43. UN Women, SeCons, (2023). Preduzetništvo žena u Srbiji, 10 godina kasnije, [*in English:* Women's Entrepreneurship in Serbia, 10 Years Later] Retrieved from: https://eca.unwomen.org/sites/default/files/202306/UN_Women_Preduzetnistvo_zena_u_Srbiji_SRB_web.pdf, (11. 2. 2024.)
44. United Nation – Women (2022) RVEE program document. UN, New York.

PROFITABILITY DETERMINANTS OF SERBIAN AGRICULTURAL COMPANIES

Bojana Novićević Čečević[1], Srboljub Nikolić[2], Snežana Jovanović[3]

**Corresponding author E-mail: bojana.novicevic@eknfak.ni.ac.rs*

ARTICLE INFO

Review Article

Received: *08 October 2024*

Accepted: *20 November 2024*

doi:10.59267/ekoPolj2501329N

UDC 65.011.44:338.435(497.11)

Keywords:

Profitability, ROA, Net profit, Total Assets, Net cash flow, Liquidity, Debt, Agriculture

***JEL**: M41, Q14, Q19*

ABSTRACT

The study examines the impact of specific factors on the profitability of agriculture companies measured through ROA. The research utilized multiple linear panel regression models, namely, ordinary least squares (OLS), fixed effects (FE), and random effects (RE). The investigation was conducted on 99 companies operating in the agricultural sector within the Republic of Serbia. The time period covered by the study is from 2020 to 2023. The results indicate that ROE and net profit have a positive impact on profitability, while the impact of net cash flow, although positive, is not statistically significant. Empirical findings show that total assets, fixed assets, debt, and liquidity have a negative impact on ROA, but only the impact of debt is statistically significant.

Introduction

Achieving and maintaining a competitive advantage in a highly dynamic market is a premise for modern enterprises. To accomplish this, it is essential to continuously analyze business operations, measure performance, compare planned objectives with achieved goals, and make significant decisions to overcome business challenges. This is because the process of measuring performance can be viewed as a control activity necessary for determining the economic potential of resources and the strategic position of the company. The success of an enterprise depends on its business activities, specifically the key driving forces and success factors, based on which it is necessary to define key performance metrics to measure the degree of fulfillment of previously defined

1 Bojana Novićević Čečević, Associate professor, Faculty of Economics Nis, Trg Kralja Aleksandra Ujedinitelja 11,18000 Niš, Sebira, Phone:+38162231770, E-mail: bojana.novicevic@eknfak.ni.ac.rs, ORCID ID (https://orcid.org/0000-0002-4269-0586)

2 Srboljub Nikolić, Associate professor, Military Academy University of Defense, Veljka Lukića Kurjaka 33, 11000 Belgrade, Serbia, Phone: +381692078252, E-mail: srboljub.nikolic@yahoo.com, ORCID ID (https://orcid.org/0000-0002-1941-5332)

3 Snežana Jovanović, Research associate,Corn institute „Zemun Polje“, Slobodana Bajića 1, 11000 Belgrade, Serbia, Phone: +381648406171, E-mail: jsnezana@mrizp.rs, ORCID ID (https://orcid.org/0000-0002-2505-9979)

strategies. Today, managers are increasingly interested in finding new ways to assess performance, that is, to measure the performance of the company. Traditional methods of performance measurement focus exclusively on financial performance metrics obtained from accounting information in financial statements. These typically provide information about the past of the company; therefore, this approach to assessing business success becomes incomplete. In today's conditions, it is essential to examine the impact of individual factors on business performance rather than merely calculating indicators.

A company's profitability is influenced by a number of firm-specific variables, including market conditions, liquidity, leverage, and financial ratios. Financial measures that show how well a business uses its resources to earn a profit include return on equity (ROE) and return on assets (ROA). Liquidity ratios also show a company's ability to pay short-term debts, which has a direct impact on operational effectiveness and, eventually, profitability. Leverage in finance can also boost returns, but too much debt can raise risk and possibly put one in financial trouble.

In the Republic of Serbia, favorable conditions exist for the development of agricultural production, with the most significant resource being agricultural land, which covers 5,097,000 hectares, or 0.54 hectares per capita. Additionally, the agricultural sector has a significant share in total foreign trade and has maintained a positive balance of foreign trade for many years (Ševkušić, 2022). Therefore, agricultural production in the Republic of Serbia has great potential and strategic importance for the development and stability of the entire economy. To align business results with actual potential, it is essential to continuously monitor, analyze, and improve the performance of agricultural enterprises.

In this regard, the first part of the paper provides a theoretical background, establishing the framework for the research. Subsequently, the selected variables for investigation are explained, and the applied methodology is outlined. The research results and discussion are presented in the final part of the paper.

Theoretical Background

Profitability is one of company's success and sustainability measure, reflecting its ability to generate profit relative to its revenue, assets, or equity. A company's profitability is influenced by a variety of factors, such as market conditions, managerial techniques, operational effectiveness, and financial performance indicators.

In their study, Choiriyah et al. (2020) analyzed the impact of several financial indicators on the stock prices of banking companies and its profitabilty. Through regression analysis, the authors examined the influence of the following factors: Return on Equity (ROE), Earnings per Share (EPS), Net Profit Margin (NPM), and Operating Profit Margin (OPM). The research found that ROA and EPS are key factors determining the stock prices of banks, while the other factors do not have a significant impact.

Milošev (2020) examined the relationship between various financial indicators and the profitability of companies through regression analysis, focusing on identifying

key factors in working capital management as significant for maintaining liquidity and operational efficiency. The study concluded that faster collection of receivables, quicker inventory turnover, longer payment periods to suppliers, and shorter cash conversion cycles positively impact the profitability of companies, as measured by Return on Assets (ROA) and net profit margin.

In their study, Rakhman et al. (2019) also examined the factors influencing profitability measured by Return on Assets (ROA) using a sample of companies from the food and beverage sector listed on the Indonesian Stock Exchange. The results indicated that cash turnover and accounts receivable turnover jointly affect ROA, while accounts receivable turnover has a partial impact on ROA.

Pandey & Diaz (2019) conducted a study on companies in the technology and finance sectors in the United States. According to empirical data, Return on Equity (ROE) is negatively correlated with Return on Assets (ROA), while Return on Sales (ROS) is positively correlated with profitability for both financial and technological firms. On one hand, the current ratio (CR) shows a positive relationship with ROA for financial firms, whereas it has a negative relationship for technology companies. Firm size has a positive impact on the profitability of technology firms.

Brewer et al. (2012) examined various indicators of financial efficiency (profitability, liquidity, and capital structure) with the aim of assessing how different factors affect the financial health of agricultural enterprises. They concluded that large agricultural enterprises with higher levels of debt are significantly more vulnerable to financial crises. Additionally, while small agricultural enterprises appear to be safer, they did not experience as much improvement in their business operations from increased activity as large enterprises did.

Ratios of liquidity, like the quick and current ratios, are essential in figuring out profitability. Higher liquidity enables businesses to satisfy their short-term obligations, which improves operational efficiency and profitability, according to a Islam et al. (2022) study. On the other hand, too much liquidity may cause resources to be underutilized, which would reduce profits (Hossain & Alam, 2019).

The purpose of study conducted by Kamau and Azuo (2014) was to investigate the relationship between working capital management (cash conversion cycle, CCC) and organizational performance of manufacturing firms in Eldoret Municipality of Uasin Gishu County, Kenya. The results show that there is a negative correlation between working capital management and both return on equity (ROE) and return on assets (ROA).

Based on this analysis in the research paper by Bolek (2014) we can see that there is a significant and positive correlation between return on current assets (ROCA) and cash conversion cycle (CCC). The ability to turn a profit could be compromised by declining CCC.

The research by Loo and Lau (2019) examines the role of working capital management components on four dimensions of business investment performance in Malaysia. These performance indicators are return on assets, return on equity, Tobin's q, and

stock performance. They reveal that high liquidity contributes positively to the firm when considering the impact of the cash conversion cycle. Therefore, managers should prioritize the importance of working capital requirements to enhance investor value.

In order to find the impact of return on assets (RoA), Kamruzzaman examines financial factors including current asset (CR), return on equity (ROE), quick ratio (QR), cash ratio (CSR), operating profit margin (OPM), total asset turnover (TAT), net profit margin (NPM), debt to total asset (DTTA), current asset turnover (CAT), fixed asset turnover (FAT), inventory turnover (IT), inventory holding period (IHP), debt ratio (DT), and earning per share (EPS) (Kamruzzaman, 2019). The impact of these factors on ROA is measured in the research using a multiple linear regression model. The conclusion is that while the majority of the factor have link with ROA, there are some factors that have a negative impact.

Profitability has been found to be correlated with the size of the company, with larger businesses typically gaining from economies of scale. According to a study by Azhar et al. (2019), larger businesses typically have higher profitability because they can distribute fixed costs among a broader customer base. However, diminishing returns may occur as firms grow, leading to inefficiencies.

Factors affecting profitability

There are a substantial body of research that explores the factors influencing the profitability of agricultural companies (Nursanti et al., 2020; Sandhar, S. K., & Janglani, S., 2013; Karduman, 2011; Sharma, A. & Kumar, S., 2011). Some of tham are: Return to equity, Capital Structure, Net profit, Current Ratio, Working capital, Total assets, Fixed assets, Size, Net cash flow, Debt, Tangibility, Liquidity and so on. For our researshe we chose: Return to equity, Net profit, Total assets, Fixed assets, Net cash flow, Debt and Liquidity.

Return on Equity (ROE) is an important financial performance metric that is calculated by dividing net income by the number of outstanding shares, and it is used to assess a company's profitability. Based on ROE, stakeholders obtain information about the efficiency with which their resources are utilized. Companies with higher levels of free cash flow are often better positioned to make additional investments (Jensen, 1986; Williamson, 1988). Furthermore, there is a clear correlation and significant impact between a firm's profitability and ROE (Pandey & Diaz, 2019).

H1: High level of ROE leads to a higher level of profitability in agricultural enterprises.

Net profit is a vital metric for assessing a company's financial performance, reflecting the income remaining after all expenses have been deducted from total revenue. It serves as a direct input in calculating Return on Assets (ROA), which is derived from dividing net profit by total assets. A higher net profit indicates efficient operational management, contributing positively to ROA. Research by Mubin et al. (2014) demonstrated that firms with robust net profits generally exhibit higher ROA, indicating effective asset utilization. Furthermore, Jayaraman, et al. (2021). emphasized that a consistent rise in

net profit enhances a company's financial stability and market reputation, attracting investors and fostering growth.

H2: Net profit of agricultural enterprises has a positive impact on ROA

Total assets, which include all of a company's resources, are a key indicator of its health and financial situation. This comprises both current and non-current assets, such as property, plant, and equipment as well as intangible assets like patents and trademarks, as well as current assets like cash and inventories that are anticipated to be turned into cash within a year. Comprehending the total assets of a company is essential for different stakeholders, such as creditors, investors, and management. This is because the information reveals the firm's potential to develop, run efficiently, and maintain overall financial stability (Alvi, 2015). The importance of total assets in determining the profitability and performance of a corporation has been emphasized by recent study. Research has shown, for example, that companies with larger total assets typically have better levels of profitability and operational efficiency (Handoyo et al., 2023). But, excessive build-up of total assets, especially in the form of receivables or inventories, may result in inefficiencies and have a detrimental effect on profitability. This implies that while overall assets are important for growth, efficient asset level management is just as important.

H3: The value of Total Assets has a negative impact on ROA.

Fixed assets are used for operations for an extended period of time, usually more than a year an is a crucial part of a business's financial structure. Plants, machinery, and real estate are included in this category of fix assets. Maintaining the enterprise's operational effectiveness and profitability requires effective fixed asset management. Revenue and profitability are directly impacted by real estate and equipment, which facilitate manufacturing and service delivery. Businesses that make investments in new equipment or facility modernization frequently see increases in productivity and cost savings (Rapposelli et al., 2024).

H4: The value of Fixed Assets in agricultural enterprises has not statistical significant for their profitability.

Net cash flow is a key financial indicator that shows how much money a business makes or spends over a certain time period. It is computed as the difference between cash inflows and outflows and offers important information on the liquidity, effectiveness of operations, and general financial health of a firm. A firm with positive net cash flow has enough cash on hand to pay its bills on time, make investments in expansion prospects, and give shareholders their money back. Maintaining operations and investing in income-generating assets are made possible by a steady positive cash flow, which boosts return on assets (ROA). Research has indicated that companies with strong operational efficiency generally manage cash flow better, which raises ROA (Bolek & Wili'nski, 2012). According to Rompotis study (2024), changes in net cash flow can have a big influence on ROA. This means that in order to maximize asset usage, businesses should try to keep their cash flow consistent.

H5: The impact of Net cash flow on ROA in agricultural enterprises are positive but statisticaly insignificant

DEBT indicates a company's ability to meet all its obligations to creditors in the long term. The value of this ratio can be obtaine by dividing total debt by total assets. The ability to fulfill obligations is recognized as a key aspect in determining the profitability of the business since it impacts the organization's ability to run efficiently over the long term (Pandey & Diaz, 2019). Highly leveraged companies, or those that strive to attract necessary funds, have a greater motivation to provide high-quality information, thereby better informing investors (Okika et al., 2019). Additionally, these companies are more prone to failure if their debt is not managed adequately (Ofek, 1993).

H6: Debt has negative but statistical significant effect on profitability.

Liquidity is the ability of a business to pay its debts on schedule in the near future. Companies with a high liquidity ratio are required to present high-quality information in their financial statements, as this is a reliable sign of the company's financial soundness. Divide current assets by current liabilities to get the liquidity ratio. Research conducted by Panigrahi (2013) and Bolek and Wiliński (2012) has demonstrated that profitability is negatively affected by liquidity. Additionally, every study shows that short-term assets and liabilities are significant parts of total assets and should be carefully examined.

H7: Liquidity has negativ impact on ROA in agricultural enterprises.

Research methodology

Data and sample

To examine the factors that determined the value of ROA, the research sample included 99 agricultural companies (large and medium-sized) operating on the territory of Republics of Serbia. Sources for data gathering were financial statements: the balance sheet, the income statement, and cash flows. Financial statement is obtained from official website of the Serbian Business Registers Agency's and the financial ratios are manually calculated in Microsoft Excel. Financial statements covering the period from 2020 to 2023. This is a period of great geopolitical changes and turbulence, caused by the outbreak of the Covid-19 pandemic and the Russian-Ukrainian conflict. Table 1 shows the definitions of the variables used in the research.

The collected data was analyzed using EViews 12 and Stata 17 software packages.

The dependent variable in this research is Return to assets (ROA) as an important metric for gauging the profitability of a company and represents a company's net income as a percentage of total assets.

In line with the theoretical backdrop, the literature study and the specified hypothesis, the independent variables are: Return to equity, Net profit, Total assets, Fixed assets, Net cash flow, Debt and Liquidity. Table 1 shows the explanation of the variables used in the research.

Table 1. Description of the panel regression analysis's variables

Variable	Acronym	Description
Return to assets	ROA	The ratio of net income to total assets
Return to equity	ROE	The ratio of net income and shareholders' equity
Net profit	NetPr	The difference between Total Revenue - Total Expenses
Total assets	TA	Sum of assets of the company
Fixed assets	FA	1. The assets which are purchased for long-term use and are not likely to be converted quickly into cash.
Net cash flow	NCF	A profitability metrics shows how much money a company makes or loses over a specific time frame.
Debt	D	The ratio of total debt to total assets
Liquidity	LIQ	The ratio of current assets to current liabilities

Source: Authors

Table 2 provides the descriptive statistics for the variables utilized in the analysis. The computed values of the variability and central tendency measures are displayed. The columns contain information on the number of observations, the arithmetic mean, standard deviations, and the maximum and minimum values of the parameters. Jarque-Bera test results are at a statistically significant level ($p < 0.05$), which indicates that the data do not have a normal distribution, which is why the logarithmic values (LROA, LROE, LNetPr, LTA, LFA, LNCF, LD, LLIQ) were used for further analysis.

Table 2. Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Maximum	Minimum
ROA	396	3.024369	9.351353	50.79000	-94.25000
ROE	396	6.067601	33.59808	74.30000	-562.4100
Net profit	396	83133.70	322207.4	3158702.	-2219162.
Total assets	396	181156.6	310991.1	3353520.	35.00000
Fixed assets	396	1958568.	3635648	32805911	16020.00
Net cash flow	396	120044.1	364686.3	3193247.	-1757304.
Debt	396	49.55187	35.46697	284.4200	1.370000
Liquidity	396	2.901843	5.312580	60.27000	0.080000

Source: Author's calculation

Research Method

The profitability of Serbian agricultural companies (ROA) is determined by seven company-specific factors that are examined in this paper. Strictly balanced datasets, or "full" time series, are used in the analysis. For testing, least-squares model (Pooled OLS), the fixed-effect model (FE), and random-effect model (RE), were employed. The model that follows is designed to use independent variables to explain dependent ones:

$$LROA_{i,t} = \alpha_i + \beta_1 LROE_{i,t} + \beta_2 LNetPr_{i,t} + \beta_3 LTA_{i,t} + \beta_4 LFA_{i,t} + \beta_5 LNCF_{i,t} + \beta_6 LD_{i,t} + \beta_7 LLIQ_{i,t} + \varepsilon_{i,t}$$

Where:

$LROA_{i,t}$ – dependent variable (logarithmic value of ROA);

i – entity, Serbian agricultural companies; t – time (year from 2020 to 2023);

α_i – intercept for each entity;

β_k - coefficient corresponding to the independent variables;

$LROE$ – independent variable (logarithmic value of ROE);

$LNetPr$ - independent variable (logarithmic value of NetPr);

LTA – independent variable (logarithmic value of TA);

LFA – independent variable (logarithmic value of FA);

$LNCF$ – independent variable (logarithmic value of NCF);

LD – independent variable (logarithmic value of D):

$LLIQ$ – independent variable (logarithmic value of LIQ);

$\varepsilon_{i,t}$ – the error term.

The analysis of the coefficients' significance will involve comparing the *p* values at the 10%, 5%, and 1% significance levels. Hausman and LM tests were used to check which of the models was the most adequate given the data in the research. The presence of heteroskedasticity was verified by the Wald test.

Results and Discussion

To examine whether there is a relationship between the selected variables, as well as the strength and direction of that relationship, we conducted a correlation analysis. Pearson's correlation coefficient indicated that there is a relationship between all the observed variables, and since its value is below 0.8, we can conclude that there is no problem of multicollinearity. This is particularly important because if Pearson's coefficient exceeds 0.8, it would indicate a high level of agreement between the independent variables themselves, which significantly complicates the interpretation of the results. The matrix of correlation coefficients is presented in Table 3.

Table 3. Correlation analysis results

Variable	LROE	LNetPr	LTA	LFA	LNCF	LD	LLIQ
LROE	1						
LNetPr	0.3770	1					

Variable	LROE	LNetPr	LTA	LFA	LNCF	LD	LLIQ
LTA	-0.1931	0.3424	1				
LFA	-0.0493	-0.0477	0.4198	1			
LNCF	0.1007	0.4620	0.2125	0.1691	1		
LD	-0.1001	-0.3030	-0.0399	-0.2066	-0.3752	1	
LLIQ	0.0019	0.0645	0.0499	0.1304	0.1493	-0.2778	1

Source: Author's calculation

Since multicollinearity issues with independent variables are not always evident in the correlation matrix, Table 4's conclusions are derived using the Variance Inflation Factor (VIF) and Tolerance.

Table 4. VIF test results

Variable	VIF	Tolerance (1/VIF)
LROE	2,14	0,467
LNetpr	1,82	0,549
LTA	1,50	0,668
LFA	1,43	0,699
LNCF	1,42	0,706
LD	1,37	0,730
LLIQ	1,09	0.914

Source: Author's calculation

As is well known, multicollinearity occurs when VIF is more than 10 and Tolerance is less than 0.10. Table 4 demonstrates that for all factors, the VIF does not exceed 10. Furthermore, none of the variables' tolerance values fall below 0.10, indicating that multicollinearity among the variables in this study is not an issue.

The results of key variables influencing the ROA of agricultural companies operating in the territory of the Republic of Serbia are shown in Table 5. Multiple regression was used in the analysis. Diagnostic tests (Hausman, LM, and Wald tests) for the adequate model were also examined and prezent in Table 5.

Table 5. Multiple Reggresion result for Serbian agricultural companies

Variable	OLS	FE	RE	Robust FE
LROE				
Coefficient	.1792355	.1622421	.16894	.1622421
Standard error	.0075133	.0070758	.0066702	.014267
t	23.86	22.93	25.33	11.37
p-value	0.000	0.000	0.000	0.000
LNtPr				
Coefficient	5.85e-06	8.49e-06	7.07e-06	8.49e-06
Standard error	9.63e-07	1.12e-06	9.48e-07	3.21e-06
t	6.08	7.59	7.45	2.65
p-value	0.000	0.000	0.000	0.009
LTA				

Variable	OLS	FE	RE	Robust FE
Coefficient	-2.19e-06	-9.92e-07	-2.06e-06	-9.92e-07
Standard error	9.20e-07	1.19e-06	9.39e-07	1.13e-06
t	-2.39	-0.83	-2.19	-0.88
p-value	0.018	0.405	0.029	0.381
LFA				
Coefficient	-1.56e-07	-3.46e-08	-1.52e-07	-3.46e-08
Standard error	7.14e-08	3.93e-07	9.40e-08	7.30e-07
t	-2.18	-0.09	-1.62	-0.05
p-value	0.030	0.930	0.106	0.962
LNCF				
Coefficient	1.70e-06	1.96e-06	1.68e-06	1.96e-06
Standard error	6.96e-07	6.44e-07	5.96e-07	1.20e-06
t	2.44	3.05	2.82	1.63
p-value	0.015	0.003	0.005	0.106
LD				
Coefficient	-.0894073	-.083941	-.0871471	-.083941
Standard error	.0069973	.0172743	.0088273	.0200677
t	-12.78	-4.86	-9.87	-4.18
p-value	0.000	0.000	0.000	0.000
LLIQ				
Coefficient	-.072566	-.0653827	-.074036	-.0653827
Standard error	.0417644	.0751901	.050494	.0568473
t	-1.74	-0.87	-1.47	-1.15
p-value	0.083	0.385	0.143	0.253
Cons				
Coefficient	6.59043	1.239945	.6471224	5.695193
Standard error	.495778	4.59	9.91	1.310765
t	13.29	5.695193	6.413186	4.34
p-value	0.000	0.000	0.000	0.000
R^2	R-squared = 0.8003; Adj R-squared = 0.7967	Within = 0.7937 Between = 0.7757 Overall = 0.7836	Within = 0.7911 Between = 0.8045 Overall = 0.7983	Within = 0.7937 Between = 0.7757 Overall = 0.7836
F	F(7, 388) = 222.13; Prob > F = 0.0000	F(7,290) = 159.41; Prob> F = 0.0000	Wald chi2(7) = 1499.58; Prob > chi2 = 0.0000	F(7,98) = 43.40; Prob > F = 0.0000
Hausman's test	chi2(3) = 8.43; Prob > chi2 = 0.0380			
LM test	chibar2(01) = 80.85; Prob > chibar2 = 0.0000			
Wald test	Chi2(99) = 8 1.0e+07; Prob>chi2 = 0.0000			

Note: ***, **, *- 1%, 5%, and 10% significance levels

Source: Author's calculation

When determining whether the data support the fixed effects (FE) or random effects (RE) paradigm, the Hausman test offers a rigorous statistical evaluation. Based on the Hausman test results the FE model is more appropriate than the RE model (r= 0,038,

p< 0,05). According to the Breusch and Pagan LM test, we can say that the RE model is more appropriate than the OLS model (r = 0.000, p< 0,05). So, we We carried out further research with the consumption that the FE model was determined to be the best suitable model. The value of Wald test is less than 0,05, so, there is an existence of a heteroskedasticity problem in the fixed effects model, which is why the robust FE was chosen as the most adequate model. All the examine model with statistical significance (Prob > F = 0.0000) are indicated by the values of the F statistics. Also, models (OLS, FE, RE and robust FE) determination coefficient indicates that about 80% of the dependent variable's changes may be explained by independent factors. The OLS FE, RE and robust FE models

According to the OLS model's results, each of observed independent variable has statistically significant effects on the dependent variable. Total assets, Fixed assets, Debt, and Liquidity have negative impacts on Return on Assets (p< 0,05). Other independent variables Return on Capital, Net profit, and Net cash flow have positive impacts. All the variable has a statistical significant (p< 0,05).

Based on the FE model results, the profitability of Serbian agricultural companies is positively impacted by Return on equity, Net profit, and Net cash flow. Total assets, Fixed assets, Debt, and Liquidity all have a negative effect. But statistical significant has only the variable Debt (p< 0,05).

The results of the RE model indicate significant positive impacts of Return on Equity, Net profit and Net cash flows on the dependent variable. The impacts of Total assets, Fixed assets, Debt, and Liquidity are negative, with the value of p statistic for variables Total assets and Debt at a statistically significant level (p< 0,05). Fixed assets and Liquidity does not have satisfactory values of the p-statistic.

Finally, results for Robust FE model show positive and statistically significant impact of Return of equity and Net profit on profitability (p< 0,05). The impact of Net cash flow is also positive but insignificant. On the other hand, Total assets, Fixed assets, Debt, and Liquidity have a negative impact on profitability, but only the impact of Debt is significant (p< 0,05).

The positive and direct impact of ROE on profitability, discovered in agricultural enterprises, is in line with the research of Shubita and Alsawalhah (2012), and Şamiloğlu et al. (2017).

Anarfo (2015) likewise finds that debt has a negative influence on ROA in his study. His research showed that debt negatively impacts ROA because most banks in the study opt for internal financing to reduce information asymmetry. A high debt ratio does not affect a firm's profitability in the research conducted by Deloof (2003) and Kebewar (2012).

In their study, Pondey and Diaz (2019) also concluded that liquidity is not statistically significant for profitability, measured by ROA, in technology companies and financial firms considered together in the United States.

Negative impact of Total Assets on ROA was recognized also in the research of Kamruzzaman (2019).

Conclusions

A large number of small agricultural producers, a fragmented market supply, lack of organized procurement and contractual relationships, ineffective inspection bodies in market regulation, absence of a collection and distribution center, slow development of the credit market, short debt financing periods, and low purchasing power of the domestic market are just some of the characteristics of the agricultural product market in the Republic of Serbia. Due to the large number of factors, both external and internal nature, agricultural enterprises have become a subject of interest for a significant number of researchers.

As agricultural activity increasingly becomes a key driver of national economic development, assessing the performance of companies operating within this sector is important for both the managers of these companies and decision-makers at the national level. The focus of the study was on examining the factors influencing the profitability of agricultural enterprises operating in the Republic of Serbia. The research sample consisted of 99 large and medium-sized enterprises. Profitability was measured using the Return on Assets (RoA) rate, which is considered one of the essential indicators. The independent variables examined included: Return on Equity (ROE), Net Profit, Net Cash Flow, Total Assets, Fixed Assets, Debt Ratio, and Liquidity.

The research findings indicated that factors such as ROE and Net Profit significantly and positively impact the profitability of the agricultural enterprises in the sample. In contrast, the positive influence of Net Cash Flow, while present, was not statistically significant. In this context, companies with higher ROE and Net Profit levels tend to have greater profitability, suggesting that these two indicators should be central to management's focus. Conversely, Total Assets, Fixed Assets, Debt, and Liquidity negatively affect the profitability (RoA) of agricultural enterprises. However, only the impact of the Debt was statistically significant. Companies with a higher level of debt tend to have lower profitability, while a lower level of debt leads to better performance. Managers should aim to balance external sourse and RoA levels effectively.

For a successful assessment of profitability and the achievement and maintenance competitive advantage among agricultural enterprises in the Republic of Serbia, attention should also be given to other external factors that can significantly contribute to improved performance. Given the diverse activities within this sector, regulatory bodies should conduct thorough analyses and provide support to ensure the proper functioning of these enterprises. Additionally, creating favorable conditions for the sustainable development of agricultural businesses is essential for their long-term success and resilience.

Acknowledgements

The research presented in this paper was done with the financial support of the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, within the funding of the scientific research work at the University of Niš, Faculty of Economics, according to the contract with registration number 451-03-65/2024-03.

Conflict of interests

The authors declare no conflict of interest.

References

1. Alvi, M., & Ikram, M. (2015). Impact of total assets and net income on return on equity of small medium enterprises of Pakistan. *MPRA Paper No. 64876*. Pakistan Institute of Learning and Living, Iqra University, Institute of Clinical Psychology.
2. Anarfo, E. B. (2015). Determinants of capital structure of banks: Evidence from Sub-Sahara Africa. *Asian Economic and Financial Review, 5*(4), 624–640. https://doi.org/10.18488/journal.aefr/2015.5.4/102.4.624.640
3. Azhar, K. A., & Ahmed, N. (2019). Relationship between firm size and profitability: Investigation from the textile sector of Pakistan. *International Journal of Information, Business and Management, 11*(2), 62.
4. Bolek, M. (2014). Return on current assets, working capital and required rate of return on equity. *Financial Internet Quarterly "e-Finanse"*, 10(2), 1-10. https://doi.org/10.14636/1734-039X_10_2_005
5. Bolek, M., & Wili'nski, W. (2012). The effect of liquidity on profitability of Polish construction sector companies. *E-Finanse: Financial Internet Quarterly, 8*(1), 38– 52.
6. Brewer, B. E., Wilson, C. A., Featherstone, A. M., Harris, J. M., Erickson, K., & Hallahan, C. (2012). Measuring the financial health of U.S. production agriculture. *Journal of the ASFMRA*
7. Choiriyah, C., Fatimah, F., Agustina, S., & Ulfa, F. A. (2020). The effect of return on assets, return on equity, net profit margin, earning per share, and operating profit margin on stock prices of banking companies in Indonesia Stock Exchange. *International Journal of Finance Research*, *1*(2), 1-15. https://doi.org/10.47747/ijfr.v1i2.280
8. Deloof, M. (2003). Does working capital management affect profitability of Belgian firms? *Jour-nal of Business Finance & Accounting, 30*(3-4), 573–588. https://doi.org/10.1111/1468-5957.00008
9. Handoyo, S., Suharman, H., Ghani, E. K., & Soedarsono, S. (2023). A business strategy, operational efficiency, ownership structure, and manufacturing performance: The moderating role of market uncertainty and competition intensity and its implication on open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*. https://doi.org/10.1016/j.joitmc.2023.100039
10. Hossain, I., & Alam, J. (2019). The relationship between liquidity and profitability in emerging countries: Evidence from Bangladesh. *Journal of Finance and Accounting, 7*(1), 22–27. https://doi.org/10.12691/jfa-7-1-4
11. Islam, M. A., Ullah, A. K. M. M., Avi, M. A. R., & Ashanuzzaman, M. (2022). Assessing the impact of liquidity on profitability: Specific to the banking industry of Bangladesh. *Journal of Business Studies, Pabna University of Science and Technology, 3*(1), 257–269. https://doi.org/10.58753/jbspust.3.1.2022.15

12. Jayaraman, G., Azad, I., & Sid Ahmed, H. (2021). The impact of financial variables on firm profitability: An empirical study of commercial banks in Oman. *Journal of Asian Finance, Economics and Business, 8*(5), 885–896. https://doi.org/10.13106/jafeb.2021.vol8.no5.0885
13. Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American Economic Review, 76*(2), 323–332.
14. Kamau, D., & Ayuo, A. (2014). The effects of working capital management on organizational performance: A survey of manufacturing firms in Eldoret Municipality. *International Journal of Economics, Commerce and Management*, 5(5), 72-85 NEMA
15. Kamruzzaman, M. (2019). Impact of the financial factors on return on assets (ROA): A study on ACME. *International Journal of Research and Innovation in Social Science, 12*(1), 50-61. DOI: 10.36481/diujbe.v012i1.54kdwn08
16. Karduman, H. et al. 2011. *The Relationship between Working Capital Management and Profitability: Evidence from an Emerging Market.* International Research Journal of Finance and Economics, 62(2011), pp. 61-67.
17. Kebewar, M. (2012). The effect of debt on corporate profitability: Evidence from French service sec-tor. *Brussels Economic Review, 56*(1), 43–59.
18. Loo, P.-Y., & Lau, W.-T. (2019). Key components of working capital management: Investment performance in Malaysia. *Management Science Letters*. https://doi.org/10.5267/j.msl.2019.7.010
19. Milošev, I. (2020). The impact of working capital management. *Poslovna Ekonomija - Business Economics*, *15*(2), 1-18. https://doi.org/10.5937/poseko20-34263
20. Mubin, M., Iqbal, A., & Hussain, A. (2014). Determinant of return on assets and return on equity and its industry-wise effects: Evidence from KSE (Karachi Stock Exchange). *Research Journal of Finance and Accounting*, *5*(15), 148.
21. Nursanti, E., Eryatna, E., Eltivia, N., & Handayawati, K. U. (2020). The effect of cash turnover, receivable turnover, and inventory turnover towards profitability of consumer goods companies in Indonesia. In *Proceedings of the 2nd Annual Management, Business and Economic Conference (AMBEC 2020)*. https://doi.org/10.2991/aebmr.k.210717.039
22. Ofek, E. (1993). Capital structure and firm response to poor performance: An empirical analysis. *Journal of Financial Economics, 34*(1), 3–30. https://doi.org/10.1016/0304-405X(93)90038-D
23. Okika, N. P., Omoregbee, G., & Echobu, J. (2019). Firm-specific attributes and Earnings Management of Listed Conglomerate Firms in Nigeria, International Conference on Accounting, Finance and Insurance – ICAF, Lagos
24. Pandey, R., & Diaz, J. F. (2019). Factors affecting return on assets of US technology and financial corporations. *JMK*, *21*(2), 134–144. https://doi.org/10.9744/jmk.21.2.134-144
25. Panigrahi, A. K. (2013). Relationship between inventory management and profitability: An empirical analysis of Indian cement companies. *Asia Paci-fic Journal of Marketing & Management Re-view, 2*(7), 107–120.

26. Rakhman, A., Zakaria, H. M., & Manda, G. S. (2019). Factors affecting return on assets. *The International Journal of Business Review (The Jobs Review)*, *2*(1), 19-28. https://doi.org/10.17509/tjr.v2i1.17772

27. Rapposelli, A., Birindelli, G., & Modina, M. (2024). The relationship between firm size and efficiency: Why does default on bank loans matter? *Quality & Quantity, 58*(6), 3379–3401. https://doi.org/10.1007/s11135-023-01810-9

28. Rompotis, G. G. (2024). Financial performance and cash flow: Evidence from the US banking industry. *Research Papers in Economics and Finance*. https://doi.org/10.18559/ref.2024.1.1042

29. Şamiloğlu, F., Őztop, A. O., & Kahraman, Y. E. (2017). The determinants of firm financial per-formance: Evidence from Istanbul Stock Ex- change (BIST). *IOSR Journal of Economics and Finance (IOSR–JEF), 8*(6-1), 62–67. DOI: 10.9790/5933-0806016267

30. Sandhar, S. K., & Janglani, S. (2013). A study on liquidity and profitability of selected indian cement companies: a regression modelling approach. *International Journal of Economics, Commerce and Management*, *1*(1).

31. Sharma, A. & Kumar, S. 2011. *Effect of Working Capital Management on Firm Profitability: Empirical Evidence from India.* Global Business Review, 12(1), pp. 159 – 173. https://doi.org/10.1177/09721509100120011

32. Shubita, M. F., & Alsawalhah, J. M. (2012). The relationship between capital structure and profitability. *International Journal of Business and Social Science, 3*(16), 104–112.

33. Ševkušić, L. Lj., Bodiroga, R. Ž., & Vukoje, V. P. (2022). The assessment and ranking of the liquidity of Serbian agricultural enterprises. *Journal of Agricultural Sciences*, *67*(3). https://doi.org/10.2298/JAS2203321S

34. Williamson, O. E. (1988). Corporate finance and cor-porate governance. *The Journal of Finance, 43*(3), 567–591. https://doi.org/10.1111/j.1540-6261.1988.tb04592.x

HISTORICAL DEVELOPMENT OF SOYBEAN PRODUCTION DEPENDING ON THE AGROECOLOGICAL CONDITIONS OF SERBIA

Zlatica Mamlić[1], Vojin Đukić [2], Petar Čanak [3], Ana Uhlarik [4], Sanja Vasiljević [5], Marija Bajagić [6], Jegor Miladinović [7]

**Corresponding author E-mail: zlatica.miladinov@ifvcns.ns.ac.rs*

ARTICLE INFO

Review Article

Received: *26 November 2024*

Accepted: *15 January 2025*

doi:10.59267/ekoPolj2501345M

UDC 635.655(497.11)

Keywords:

Glycine max, climate changes, soybean history, production trends, soybean in Europe

***JEL**: E23, N54, O13, Q19*

ABSTRACT

In order for the production of a plant species to take a significant place in the crop structure, in addition to favorable agro-ecological conditions, there must be a national strategy. After the state implemented the "action" plan, the processing sector and breeding, i.e. the development of high-yielding domestic varieties, with good adaptability and stability, intensified. This implied that Serbia would become the only country in Europe that produces enough soybeans for its own needs. The aim of the research is the influence of agro-climatic conditions on soybean production in the province of Vojvodina. High-yielding soybean varieties contributed to an average yield of over 3,000 kg ha-1 for the period 2010-2019. Intensive development of new soybean varieties is aimed at addressing climate change, which has become increasingly unfavorable. Data indicate that interest in soybean production in Serbia is growing and this trend is expected to continue in the future.

1 Zlatica Mamlić, Senior Scientific Advisor, Institute of Field and Vegetable Crops, Maksima Gorkog 30, 21000 Novi Sad, Serbia, Email: zlatica.miladinov@ifvcns.ns.ac.rs, ORCID ID (https://orcid.org/0000-0002-8564-8249)

2 Vojin Đukić, Scientific Advisor, Institute of Field and Vegetable Crops, Maksima Gorkog 30, 21000 Novi Sad, Serbia, Email: vojin.djukic@ifvcns.ns.ac.rs, ORCID ID (https://orcid.org/0000-0002-6615-805X)

3 Petar Čanak, Senior Scientific Advisor, Maize Research Institute "Zemun Polje", Slobodana Bajića 1, 11185 Belgrade, Serbia, Email: pcanak@mrizp.rs, ORCID ID (https://orcid.org/0009-0001-8661-8965)

4 Ana Uhlarik, Scientific Associate, Institute of Field and Vegetable Crops, Maksima Gorkog 30, 21000 Novi Sad, Serbia, Email: ana.uhlarik@ifvcns.ns.ac.rs, ORCID ID (https://orcid.org/0000-0002-7587-2247)

5 Sanja Vasiljević, Scientific Advisor, Institute of Field and Vegetable Crops, Maksima Gorkog 30, 21000 Novi Sad, Serbia, Email: sanja.vasiljevic@ifvcns.ns.ac.rs, ORCID ID (https://orcid.org/0000-0003-2042-1542)

6 Marija Bajagić, Assistant Professor, University Bijeljina, Faculty of Agriculture, Pavlovića put bb, 76300 Bijeljina, Republic of Srpska, Bosnia and Herzegovina, Email: bajagicmarija@yahoo.com, ORCID ID (https://orcid.org/0000-0001-9537-8302)

7 Jegor Miladinović, Scientific Advisor, Institute of Field and Vegetable Crops, Maksima Gorkog 30, 21000 Novi Sad, Serbia, Email: jegor.miladinovic@ifvcns.ns.ac.rs, ORCID ID (https://orcid.org/0000-0002-4061-4037)

Introduction

Soybeans originate from China. Most scientists believe that the origin of this plant species is the Yunnan-Guizhou plateau. Also, it is widely believed that modern cultivated soybean was domesticated from wild soybean (*Glycine soja* Sieb. & Zucc.) in East Asia 6,000-9,000 years ago (Milojević et al., 2020; Kim et al., 2012). The recent history of soybeans began in the 19th century in America, where it spread across the globe and took on a significant role in modern agriculture (Pantić et al., 2022; Whigham, 1983). It was brought to Europe in 1692, thanks to botanist Engelbert Kaempfer. Its cultivation in Europe began in the 19th century, with the first planting in France in 1840. Until then, soybeans were only grown in botanical gardens. From France, it spread to Austria and other European countries. Significant soybean cultivation in America and Europe began between the two world wars, initially for producing bulk animal feed and increasingly for grain production (Penjišević et al., 2024; Davydenko et al., 2004). Today, soybeans are grown in all parts of the world, with the main production centers being South and North America. The share of Europe in total world soybean production is 1-2%, and this plant is important only for certain countries. Significant fluctuations in areas, primarily in EU countries, result from reduced subsidies and lower profits for the producers, despite record yields. Due to these factors, Russia and Ukraine have emerged as the primary producers of soybeans in Europe. The four largest soybean-producing countries in Europe are the Russian Federation, Ukraine, Italy, and Serbia, followed by France and Romania (FAOSTAT, 2022).

Serbia is the only country in Europe that produces enough soybeans for its needs. Soybean has been present in Serbia since the beginning of the 20th century, but the areas varied greatly. Poor knowledge of the use value of soybeans and their products by agricultural producers meant that it could not occupy a significant place in the structure of agricultural production (Bošković, 1966). Soybean is mainly grown in Vojvodina. Today, the areas under soybeans in this area make up about 93% of the total area of this crop in Serbia (Mihajlović et al., 2024; Bošnjak and Rodić, 2010). In Vojvodina, the grain yield of soybean is dependent on RGS (the amount and distribution of rainfall during the growing season) because production is exclusively organized under dry land farming conditions. Information on the amount and distribution of rainfall is a very important strategy for soybean productivity because it is estimated that extreme weather conditions (drought and heat waves) will become even more intensive in the future (Lalić et al., 2011).

Therefore, it is crucial to analyze the soybean production trend over a span of seven decades (1950-2019) in the region of Serbia. This analysis aims to establish the potential impact of weather conditions, precipitation levels, and average monthly air temperature on the production specifically in the province of Vojvodina, which accounts for 93% of the total production of this plant species.

To analyze soybean production in Serbia, data for harvested area, production, and yield of soybean were used from the Agriculture in Serbia, 1947-1996 (1998) and Statistical Yearbook of the Republic of Serbia from 1997 to 2019.

Materials and methods

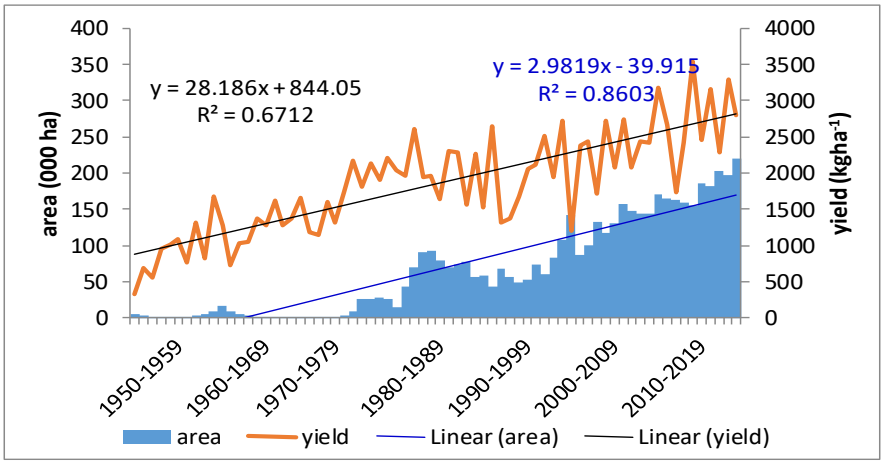
To analyze soybean production in Serbia, data for harvested area, production, and yield of soybean were used from the Agriculture in Serbia, 1947-1996 (1998) and Statistical Yearbook of the Republic of Serbia from 1997 to 2019.

Results and Discussions

Trend of soybean production in the Serbia from 1950-2019

The results showed that from 1950-2019, the area under soybeans increased from 4,312 ha to 220,000 ha, i.e. 51 times more with a tendency for further growth (*Figure 1*). In this way, Serbia has become a significant producer of soybeans in Europe. In Serbia, the production of genetically modified soybeans is not allowed (Official Gazette of the RS", No. 41/2009), which enables Serbia to export this plant species to markets that exclude the use of GMOs and for soybeans produced in Serbia to be in high demand on the European market. According to data According to the European Commission (2013)[8], about 90% of the total soybean production in the world comes from genetically modified varieties. Since European consumers are distrustful of GMO technology and taking into account that there is a growing interest in products that do not contain GMOs, retail chains and other relevant institutions support sustainable compositions in the production of soybeans that are not genetically modified (Rizov and Rodriguez-Cerezo, 2015). In addition to the area, the average soybean yield also increased significantly. In 1950, the average yield was 336 kg ha^{-1}, and in 2019 it was 2800 kg ha^{-1}. In seventy years, the soybean yield has increased more than 8 times. However, in some years of the last decade, significantly higher yields were achieved than in 2019. The maximum yield was achieved in 2014. It amounted to 3539 kg ha^{-1}, which is more than 10 times compared to 1950.

Figure 1. Areas and yields by decades in the period from 1950-2019



Source: https://www.hidmet.gov.rs/index_eng.php

8 https://commission.europa.eu/publications/annual-activity-reports-2013_en

Analysis of production by decades

In accordance with *Table 1*, where data are summarized by decade, a detailed analysis of the impact of various factors on yield increase is described for each year. The yield increase was influenced by several factors, but the most important was the choice of genotype and the applied agricultural production techniques.

Table 1. Correlations of areas and yields by decades in the period from 1950-2019

Decades	Average areas (ha)	Average yield (kg ha^{-1})	Correlation coefficient of average areas	Correlation coefficient of average yields
1950-1959	1390	917	Y= 330,8x-429,8 R^2= 0,4126	Y=119,27x+261,2 R^2=0,7475
1960-1969	1372	1187	Y= -634,83x+4863,7 R^2= 0,4074	Y= 14,352x+1108,1 R^2= 0,0169
1970-1979	10599	1763	Y= 3553,1x-8942,9 R^2= 0,8352	Y= 115,45x+1128,4 R^2= 0,6248
1980-1989	59287	1995	Y= 2780,3x+43995 R^2= 0,1629	Y= 19,4x+1888 R^2= 0,0446
1990-1999	58444	2001	Y= 4477,5x+33818 R^2= 0,5425	Y= 89,121x+1510,7 R^2= 0,259
2000-2009	121342	2309	Y= 3992,8x+99381 R^2= 0,34	Y= 76,333x+1888,7 R^2= 0,2083
2010-2019	165778	2806	Y= 5427,8x+135925 R^2= 0,6697	Y= 43,309x+2567,4 R^2= 0,0541

Source: Authors

Soybean has been present in Serbia since the beginning of the 20th century. In the beginning, it was cultivated as a substitute for coffee, because agricultural producers were not sufficiently educated about its utility value. Observing the period from 1950 to 1959, it can be seen that the area under soybeans in Serbia ranged from 857 ha in 1953 to 8443 ha in 1959, and the average yields ranged from 336 kg ha^{-1} in 1950 to 1675 kg ha^{-1} in 1959. In the period from 1959-1961, another attempt to expand the area under soybeans was recorded. However, a significant decline was recorded in the following period. At the beginning of the seventies, in 1972, soybeans were sown on only 625 ha. The reason for the weak spread of this plant species is the lack of tradition, i.e. insufficient knowledge of soybean, weak economic motivation, and a lack of capacity for processing high-quality products (Bošković, 1966). A significant increase in the area under soybeans began in 1975, when the state adopted an action plan and opened processing capacities. That year, 9,683 ha were sown under soybeans, and 25,944 ha the following year. In the next few years, a moderate increase in areas was recorded, except in 1980, when there was a significant decrease in areas. What characterizes the next two decades of production (1980-1989 and 1990-19999) are large oscillations in surfaces. After the adoption of the action plan by the state, yields above 2000 kg ha^{-1} were achieved for the first time. In 1982, an average yield of 2606 kg ha^{-1} was achieved, which shows not only that there are favorable natural conditions for growing soybeans, but also that agricultural producers have learned and mastered the production technology (Miladinović et al., 2008). In the

mid-seventies, intensive work on soybean breeding and cultivation technology began at the Institute for Crop and Vegetable Farming in Novi Sad. The first soybean variety was registered in 1979 (NS Kasna). However, only introduced, American soybean varieties are present in production: Evans, Hodgson, Hark, Amsoy, and Corsoy. In 1983, the soybean processing factory in Bečej began operating, which contributed to the further increase of the area under soybeans in Vojvodina. With the introduction of high-yield domestic soybean varieties (NS-6, NS-9, NS-10, NS-16 and NS-21), which suppressed foreign, introduced soybean varieties, the average yield of soybeans per hectare continued to increase. During the 1990s, varieties selected at the Institute of Agriculture, i.e. domestic varieties Ravnica, Balkan, and Vojvođanka very quickly occupied a significant place in the sowing structure and completely suppressed the introduced American soybean varieties. In the next two decades, along with corn, wheat, and sunflower, soybean became the leading plant species in the fields, and Serbia became one of the most important producers of this plant species in Europe. In the period from 2010 to 2019. There were four years with a yield above 3000 kg ha^{-1}, which speaks in favor of the fact that soybean producers have mastered the production technology of this plant species well and that they have at their disposal top-quality, high-yielding soybean varieties with good adaptability and stability. Also, the above data indicate that interest in soybean production in Serbia is still growing and that this trend will continue in the coming years.

Analysis of the influence of weather conditions on soybean yield in the province of Vojvodina - Serbia

Vojvodina - Serbia is a production area recognizable by its favorable natural conditions for organizing agricultural production. This statement is primarily supported by the available funds of arable land, which makes up nearly 90% of the total agricultural land in this area (Bošnjak and Rodić, 2011). If we take into account the fact that over 43% of the total territory of Vojvodina consists of chernozem (Hadžić et al., 2005), then Vojvodina is certainly an area with significant land production potential.

For the analysis of agrometeorological conditions on soybean production, data taken from Meteorological yearbooks (Republic Hydrometeorological Service of Serbia) including seven meteorological stations that have data on monthly rainfall (*Table 2*) were used. Selected rainfall stations are equally distributed in the region of Vojvodina (one station per 3000 km^2).

Table 2. List of meteorological stations included in the study

Station	Latitude	Longitude	Amplitude (m)
Novi Sad	45° 15’ 46”	019° 51’ 07”	84
Palić	46° 06’ 11”	019° 45’ 31”	102
Sombor	45° 47’ 00”	019° 07’ 00”	89
Kikinda	45° 49’ 41”	020° 27’ 55”	81
Zrenjanin	45° 21’ 55”	020° 24’ 13”	81
Banatski Karlovac	45° 02’ 58”	021° 01’ 00”	99
Sremska Mitrovica	44° 59’ 00”	019° 37’ 00”	82

Source: Authors

Data during the growing season of soybeans (April-September) on the sum of precipitation and average air temperature are shown in *Table 3*. Sum of precipitation in the growing season from 1950 to 2019 was 365.3 mm, while the average air temperature was 18.2°C. When looking at rainfall by decade, a significant difference can be seen.

Table 3. The sum of precipitation (mm) and average mean temperature (°C) for the multi-year period 1950–2019

Year / Mounth	1950-1959	1960-1969	1970-1979	1980-1989	1990-1999	2000-2009	2010-2019
The sum of precipitation (mm)							
April	53.3	42.7	46.6	55.3	42.3	46.3	50.7
May	64.8	52.4	57.3	67.6	59.8	61.6	105.8
June	88.0	69.2	88.0	84.4	83.5	97.5	86.3
July	60.4	74.8	66.9	44.6	88.6	56.3	57.0
August	52.6	42.9	72.9	51.5	58.3	53.0	57.3
September	35.5	37.1	35.6	33.7	56.2	63.0	54.7
Sum	**354.6**	**319.1**	**367.2**	**337.0**	**389.6**	**377.6**	**411.7**
Average mean temperature (°C)							
April	11.1	11.9	10.9	11.3	11.3	12.6	13.4
May	16.1	16.4	16.5	16.6	16.8	18.0	17.3
June	20.0	19.9	19.6	19.2	20.2	20.8	21.5
July	22.2	21.1	20.7	21.4	21.7	22.5	23.1
August	21.4	20.7	20.2	20.8	21.7	22.1	23.3
September	17.1	17.2	16.0	17.6	16.7	16.7	18.1
Average	**18.0**	**17.9**	**17.3**	**17.8**	**18.1**	**18.8**	**19.4**

Source: Authors

The maximum amount of precipitation during the growing season was recorded in the period from 2010 to 2019, 411.7 mm, and the minimum in the period from 1960 to 1969, 319.1 mm. In the period from 2010 to 2019, there was 92.6 mm, or 22.40%, more precipitation during the growing season than in the period from 1960 to 1969. Also, in the last three decades, from 1990 to 2019 there was more precipitation per decade than in the period from 1950 to 1989.

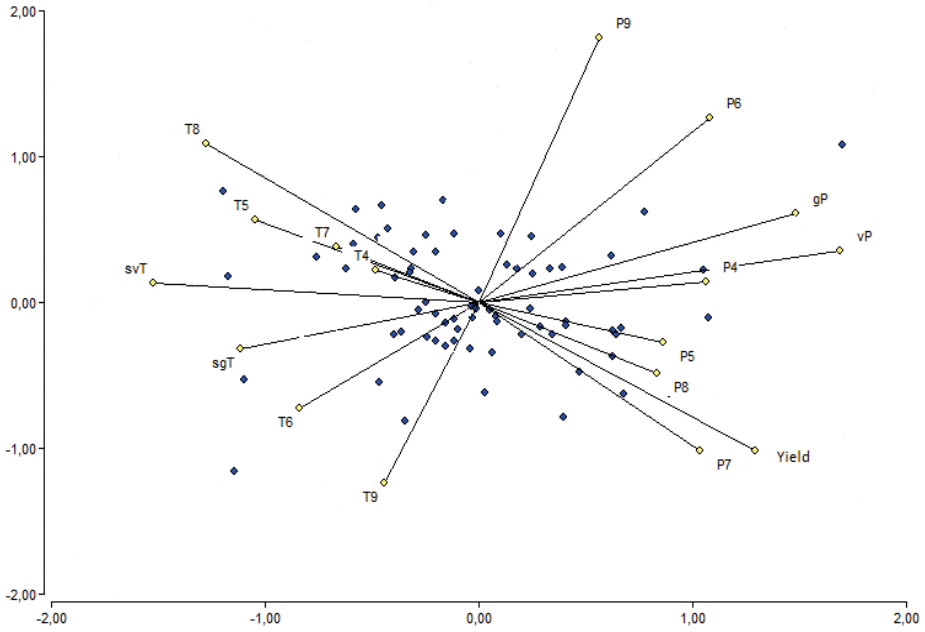
A significant difference was also found in the average air temperature if observed by decades. The maximum average temperature was determined in the period from 2010 to 2019, 19.4°C, and the minimum in the period from 1970 to 1979, 17.3°C. In the period from 2010 to 2019, the average air temperature was 2.1°C higher than in the period from 1970 to 1979. Also, there has been a significant increase in average temperatures in the last three decades, from 1990 to 2019, than in the period from 1950 to 1989.

Soybean is one of the most important oil and protein crops in the world and is grown under a wide range of environmental conditions, where climate factors such as temperature, photoperiod, and moisture stress exert a detrimental effect on plant growth and metabolism (Khan et al., 2007; Shirazi et al., 2024). There is a lot of research on the topic of the critical period of soybean development. Some authors point out that the

lack of rainfall and high temperatures in the flowering phase have the greatest impact on soybean yield (Foroud et al., 1993), while others have come to the conclusion that weather conditions during pouring have a greater effect on yield (Shadakshari et al., 2014; Giordani et al., 2019). In general, weather conditions during the entire generative period of soybeans have a significant impact on soybean yield (Miladinov et al., 2020; Mamlić et al., 2024). In the Republic of Serbia, that is, in its province Vojvodina, the generative period of soybeans begins at the end of June and ends at the end of August. When it will start and how long the generative period will last depends primarily on weather conditions, the soybean ripening group, and the sowing date. In *Figure 2*, you can see that connection-that is, a very strong positive connection between yields and precipitation during the months of July and August.

Figure 2. Dependence of yield on agrometeorological conditions during the growing season

(T4-T9 average monthly air temperatures from April to September; P4-P9 average monthly rainfall, gP-annual sum of rainfall; vP-sum of precipitation during the growing season; gT-average annual air temperature; vT-average temperature during vegetation)



Source: Authors

Somewhat weaker, but also positively, it was affected by precipitation in April. In addition to the reproductive period, germination and initial growth also affect yield because they determine crop composition and uniformity (Cheng and Bradford, 1999; Đukić et al., 2017). In Vojvodina, the optimal time for sowing soybeans is during the

month of April, so soil moisture or rainfall has an impact on the yield. However, this connection is not as strong as in the reproductive period, which can be seen in the graph. The rainfall in June had very little, and the rainfall in September had no effect on the soybean yield because it was already in the ripening phase. When soybeans suffer high temperatures during the seed-filling stage, their yields are reduced, and their seed compositions change (Nakagawa et al., 2020). The same conclusion, about the influence of high temperatures on the yield of soybeans, can be made in these studies by looking at *Figure 2*. The most negative impact on the yield was the high temperature in the month of August when soybeans were mostly in the seed-filling phase. Also, a very strong negative impact of high temperatures in April, May, and July can be observed. Djanaguiraman and Prasad (2010) determined that temperatures higher than optimal during the vegetative period reduce photosynthetic activity and increase the rate of ethylene production, which leads to aging of the leaves. The consequence of all this is a decrease in yield. Puteh et al., (2013) point out that in the flowering phase at temperatures above the optimum, the intensity of photosynthesis and pollen germination decrease, which results in a lower number of pods and weight of 1000 seeds. In the research conducted by Lobell and Asner (2003), it is stated that with each increase of the mean vegetative temperature by 1°C compared to the optimum, the soybean yield decreases by as much as 17%.

Conclusions

Soybean cultivation in Serbia does not have a long tradition, although there are favorable agroecological conditions for it. In order for a plant species to establish itself in production, there must also be an economic interest in its cultivation. Therefore, only with the adoption of the action plan by the state did this plant species begin to occupy a significant place in the sowing structure. Today, soybean is in fourth place in Serbia, after corn, wheat, and sunflower. In addition to the establishment of factories for obtaining final products from soybeans, a great contribution to this success was made by the Institute for Crop and Vegetable Agriculture, i.e. the creation of domestic high-yielding varieties with good adaptability and stability. The research results also show that the interest in soybean production in Serbia is still growing, and this trend will continue in the coming years.

Acknowledgements

„This research was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, grant number: 451-03-66/2024-03/200032“

Conflict of interests

The authors declare no conflict of interest.

References

1. Agriculture in Serbia 1947-1996 (1998). *Agriculture in Serbia 1947-1996 (50 year series of statistics*). Statistical Office of the Republic of Serbia, Belgrade.
2. Bošković M. (1966). *The state and possibilities of soybean production in Serbia.* in: Soybean, production, processing, consumption, Zagreb, 103-112.
3. Bošnjak D., & Rodić V. (2011). The use of arable land in the function of the development of agricultural production in Vojvodina. *Agroznanje*, 12(3): 337-346.
4. Bošnjak D., & Rodić V. (2010). Economic analysis of soybean production in Vojvodina. *Ratarstvo i povrtarstvo*, 47(1): 193-202.
5. Cheng Z., & Bradford K. J. (1999). Hydrothermal time analysis of tomato seed germination responses to priming treatments. *Journal of Experimental Botany*, 33: 89-99.
6. Davydenko O. G., Goloenko V. E., & Rozentsveyg V. E. (2004). *Soybeans for moderate climate*. Tehnologiya, Minsk, Belarus.
7. Djanaguiraman M., & Prasad P. V. V. (2010). Ethylene production under high temperature stress causes premature leaf senescence in soybean. *Functional Plant Biology*, 37: 1071-1084.
8. Đukić V., Miladinov Z., Dozet G., Cvijanović M., Tatić M., Miladinović J., & Balešević-Tubić S. (2017). Pulsed electromagnetic field-a cultivation practice used to increase soybean seed germination and yield. *Zemdirbyste-Agriculture*, 104(4): 345-352.
9. FAO (2022). FAOSTAT. Retrieved from http://www.fao.org/faostat/en/#home (October 4, 2024).
10. Foroud N., Mundel H. H., Saindon G., & Entz T. (1993). Effect of level and timing of moisture stress on soybean yield components. *Irrigation Science* 13: 149-155
11. Giordani W., Gonçalves L. S. A., Moraes L. A. C., Ferreira L. C., Neumaier N., Farias J. R. B., Nepomuceno A. L., de Oliveira C. N., & Mertz-Henning L. M. (2019). Identification of agronomical and morphological traits contributing to drought stress tolerance in soybean. *Australian Journal of Crop Science*, 13(1): 35.
12. Hadžić V. B., Sekulić P., Vasin J., &Nešić L. (2005). Geological basis of the land cover of Vojvodina. Economics of Agriculture, 52(4): 429-438
13. Khan A. Z., Khan H., Ghoneim A., Khan R., & Ebid A. (2007). Seed quality and vigor of soybean as influenced by planting date, density and cultivar under temperature environment. *International Journal of Agriculture Research,* 2(4): 368-376.
14. Kim M. Y., Van K., Kang Y. J., Kim K. H., & Lee S-H. (2012). Tracing soybean domestication history: from nucleotide to genome. *Breeding Science,* 61: 445-452.
15. Lalić B., Mihailović D.T., & Podraščanin Z. (2011). Future state of climate in Vojvodina and expected effects on crop production. *Ratarstvo i povrtarstvo*, 48(2): 403-418

16. Lobell D. B., & Asner G. P. (2003). Climate and management contributions to recent trends in US agricultural yields. *Science*, 299 (5609): 1032-1032.
17. Miladinović J., Hrustić M., & Vidić M. (2008). *Soybean*, monograph, Institute of Field and Vegetable Crops, Novi Sad, Sojaprotein, Bečej. 513.
18. Miladinov Z., Maksimović I., Balešević-Tubić S., Miladinović J., Đorđević V., Vasiljević M., & Radić V. (2020). The impact of water deficit on the soybean (*Glycine max* L.) reproductive stage of development. *Legume Research*, 43(5): 693-697.
19. Mamlić Z., Đukić V., Vasiljević S., Miladinović J., Bajagić M., Dozet G., & Đurić N. (2024). Application of plant aqueous extracts on yield and quality parameters of soybean seeds (*Glycine max* L.). *Legume Research*, ***47(5):*** 803-809.
20. Mihajlović, M., Marković, S., Vujanić, I., P. Marijanović, R., & Hemed Ramadhani, I. (2024). Knowledge and information management in the company as a strategic business resource. *Oditor*, *10*(3), 53-67. https://doi.org/10.59864/Oditor32403MM
21. Milojević, I., Mihajlović, M., & Pantić, N. (2020). Collection and documentation of audit evidence. *Oditor*, *6*(2), 77-90. https://doi.org/10.5937/Oditor2002077M
22. Nakagawa A. C. S., Ario N., Tomita Y., Tanaka S., Murayama N., Mizuta C., Iwaya-Inoue M., & Ishibashi Y. (2020). High temperature during soybean seed development differentially alters lipid and protein metabolism. *Plant Production Science*, 23: 504-512.
23. 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
24. Penjišević, A., Somborac, B., Anufrijev, A., & Aničić, D. (2024). Achieved results and perspectives for further development of small and medium-sized enterprises: statistical findings and analysis. *Oditor*, *10*(2), 313-329. https://doi.org/10.59864/Oditor102402AP
25. Puteh A. B., Thuzar M., Mondal M. M. S., Abdullah N. A. P. B., & Halim. M. R. A. (2013). Soybean [*Glycine max* (L.) Merrill] seed yield response to high temperature stress during reproductive growth stages. *Australian Journal of Crop Science*, 7(10): 1472-1479
26. Rizov I., & Rodriguez-Cerezo E. (2015). *Best practice documents for coexistence of genetically modified soybean crops with conventional and organic farming* (EUR 26780). Luxembourg: European 51 Commission, Joint Research Centre.
27. Shadakshari T. V., Yathish K. R., Kalaimagal T., Gireesh C., Gangadhar K., & Somappa J. (2014). Morphological response og soybean under water stress during pod development stage. *Legume Research*, 37(1): 37-46.

28. Shirazi, R. M., Shirzadi, M. H., Aien, A., & Afsharmanesh, G. H. R. (2024). Effect of Different Irrigation Regimes on the Yield and Qualitative Characteristics of Different Cultivars of Soybean (Glycine max L.) in Jiroft. *Legume Research*, *47*(1), 59-63.
29. Statistical yearbook of the Republic of Serbia (1997-2019). Statistical Office of the Republic of Serbia, Belgrade https://www.stat.gov.rs/en-us/ (September 10, 2024)
30. Whigham D. K. (1983). Soybean. *In Symposium on Potential Productivity of Field Crops under Different Environments*. IRRI, Los Baños, 205-225.

THE SYNERGY BETWEEN GASTRONOMY AND ACTIVE TOURISM AS INDICATORS OF SUSTAINABLE RURAL WELLNESS AND SPA DESTINATION DEVELOPMENT - SOKOBANJA CASE STUDY

Martina Arsić[1], Aleksandra Vujko[2], Dragan Nedeljković[3]

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

ARTICLE INFO

Review Article

Received: *13 December 2024*

Accepted: *20 January 2025*

doi:10.59267/ekoPolj2501357A

UDC 338.48-6:615.8(497.11 Sokobanja)

Keywords:

gastronomy, active tourism, rural destination, wellness and spa, development, Sokobanja

***JEL**:L83, Z32*

ABSTRACT

This study investigated the relationship between recreation and gastronomy as key indicators of sustainable development in spa destinations. The research sought to answer two main questions: "What significance do recreation and active tourism hold for tourists?" and "What type of gastronomy attracts tourists to destinations?" The data from collected 243 respondents, comprising guests of the Sunce Hotel, Golden View Garni Hotel, and visitors to the Zelengora restaurant in Sokobanja, were analyzed using factor analysis. The authors conducted the research using two questionnaires. The findings of the first survey revealed a strong inclination to relaxation of both mind and body. Additionally, the results of the second survey indicated that a unique gastronomic experience is a significant motivator for tourists. Both indicators have a positive impact on tourists' overall well-being and foster loyalty to the destination. In conclusion, active, gastronomic, wellness, and spa tourism have a beneficial influence on the tourist destination of Sokobanja. The study proposes a unique model that can be applied to all rural spa destinations.

Introduction

Numerous factors, such as the quality of offered experiences and the perception of the destination, affect tourist well-being (Panić et al., 2024). Destinations that combine attributes of sensemaking (e.g., accessibility, amenities) with exploratory attributes

1 Martina Arsić, Ph.D. student, Singidunum University, Faculty of Tourism and Hotel Management Danijelova 32, Belgrade 11000, Serbia, E-mail: martina.arsic.23@singimail.rs; ORCID ID (https://orcid.org/0009-0004-5709-1561)

2 Aleksandra Vujko, Ph.D., Associate Professor, Singidunum University, Faculty of Tourism and Hotel Management, Danijelova 32, Belgrade 11000, Serbia, Phone: +381 64 138 55 66, E-mail: aleksandravujko@yahoo.com, ORCID ID (https://orcid.org/0000-0001-8684-4228)

3 Dragan Nedeljković, Ph.D., Research assistant, Institute of Agricultural Economics, Volgina 15, Belgrade, Serbia, E-mail: draganedeljkovic62@gmail.com, ORCID ID (https://orcid.org/0000-0002-8391-9703)

(e.g., attractions, activities) tend to enhance tourists' psychological well-being (Kim & Hall, 2022). This can have a positive impact on increased return intentions and positive word-of-mouth (Reitsamer et al., 2017). Spa tourism, as one of the earliest forms of travel, is particularly well-developed in Europe. Serbia recognizes the significant tourist potential of its numerous spas (Arsić et al., 2024). Spa tourism has evolved from being solely health-focused to encompass mass holidaying and relaxation (Fernández-Gámez et al., 2018).

There is a growing demand for a tourist offering that integrates traditional spa experiences, modern wellness concepts, active holidays, and gastronomic experiences. Among motives that make tourists visit a destination, gastronomy ranks third behind cultural interest and nature (Juan et al., 2019). Gastronomy plays a strategic role in tourist destinations, influencing tourist behavior, motivation, experience, and spending while contributing to the sense of place and food image (Seyitoğlu et al., 2020). Gastronomic tourism has emerged as a distinct and expanding market segment (Balderas-Cejudo et al., 2019; Milanović et al., 2023; Rangus et al., 2023; Vujko & Delić-Jović, 2024), with 15% of tourists choosing destinations specifically for their culinary offerings (Berbel-Pineda et al., 2019). Moreover, a substantial 25% of travel budgets is allocated to food and beverages (World Food Travel Association, 2023). Today, gastronomy, as the focus of the tourist experience, plays an essential role in strengthening competitiveness (Vujko et al., 2024). The hospitality industry, including tourism, has become a global phenomenon, intertwining food consumption with other services and experiences valued by postmodern consumers (Hjalager & Richards, 2003). The relationship between food and identity is strong, and any attempt to change eating habits feels like an offense to national and individual identity (Bastenegar, 2019). Serbian cuisine, with its rich history and diverse influences from Greek, Byzantine, Oriental, Austro-Hungarian, Russian, and French cultures, reflects this complex heritage (Djordjevic-Milosevic & Milovanovic, 2012; Pantović et al., 2023).

Outdoor adventure tourism can foster sustainability and well-being by encouraging connections with nature, which can lead to pro-environmental attitudes and behaviors (Hanna et al., 2019). Winter et al. (2019) highlight the sustainability benefits of outdoor recreation and nature-based tourism, emphasizing the need for adaptable service delivery, cultural shifts, and inclusive management strategies to address evolving social, economic, and environmental conditions. According to Bojović et al. (2024), recreational tourism is categorized as a sustainable form of tourism that contributes to human health. Destinations that offer a blend of activities and natural environments are particularly popular due to their positive impact on the body in general (Alexander et al., 2021; Krunić et al., 2023; Miletić et al, 2023). Such destinations, with their diverse amenities, have sustainable development potential and can achieve a competitive advantage through effective tourism market positioning (Bjelić et al., 2024; Vučićević et al., 2024). Given the prevalence of stressors in modern life, destinations that offer preventive and immunity-enhancing health benefits are increasingly valued (Fernández-Gámez et al., 2024; Pantović et al., 2025). European demand for recreational and nature-based tourism is increasing due to

demographic shifts, evolving consumer preferences, and increasingly mobile lifestyles, posing challenges for planners and managers (Weber, 2001; Pyo, 2005; Bell et al., 2007). Serbia's abundant natural resources, including mountains, rural destinations, and spas, offer significant potential for recreational tourism development. Recreational activities not only enhance tourist well-being but also support therapeutic outcomes by having a positive impact on emotions (Gyasi et al., 2023).

Environmental protection is one of the most pressing challenges of the 21st century. Therefore, further tourism development must strike a balance between tourism development and ecosystem preservation as a solution to sustainability issues. The concept of wellness and spa (Arsić et al., 2024) has transcended the boundaries of mere luxury, emerging as a vital aspect of contemporary life. In today's fast-paced world filled with mounting stressors, the wellness and spa industry offers a sanctuary for individuals seeking refuge and rejuvenation (Colas et al., 2024). The benefits of wellness and spa services extend beyond mere indulgence; they play a crucial role in enhancing physical health and overall quality of life (Dimitrovski & Todorović, 2015). One of the most significant physical health benefits derived from these services is the promotion of relaxation, which can lead to reduced levels of cortisol, a hormone associated with stress (Ladkin et al., 2021, Milojević et al., 2020; Lakićević et al., 2024). In rural wellness and spa destinations, recreational and gastronomic activities are pivotal to sustainable development. The long-term viability and market competitiveness of these destinations depend on sustainable tourism practices (Zhu & Xu, 2022). Only when businesses operating in these destinations are viable can there be a competitive edge in the market. The starting hypothesis (H) posits that inbound tourism, driven by rich gastronomy and ample opportunities for sports and recreation, can enrich the offerings of wellness and rural spa destinations, positioning them as indicators of sustainable development. It is crucial to distinguish between treatment programs and wellness services in order to effectively cater to both patients and healthy guests (Arsić et al., 2024). Evidently, spa destinations that embrace these changes will gain a competitive edge in the tourism market.

The authors conclude that tourists readily engage in recreational tourism, recognizing its therapeutic benefits for general physical health. This aligns with the core principles of fitness, wellness, and spa methodologies. Additionally, they emphasize the value of locally sourced, traditionally prepared food as a significant complement to the overall tourism experience.

Case Studies

The local development of a tourist destination or region is impacted by cultural values, identity, and specific resources such as collective history and heritage (Santiago et al., 2024). Many destinations have recognized the potential of reviving tourism by empowering local communities to promote their skills and culinary heritage (Vujko et al., 2024). The Istrian region and Opatija in Croatia, Pirot in Serbia, and the Haut Plateau de l'Aubrac in France are good examples of the strong connection between

gastronomy and active recreation. These destinations leverage this connection to drive sustainable rural development (Vujko & Delić-Jović, 2024).

Istria, the most developed rural area in Croatia, has successfully developed both coastal and inland tourism. Its tourist offerings are renowned for olive oil, asparagus, truffles, and wine. The region offers family-friendly accommodations, agricultural holdings, and various active holiday options like horseback riding, cycling, and wine tours (Jurišić, 2024). Istrian wellness centers provide year-round relaxation through diverse packages.

Opatija, a coastal city in Croatia, has been identified by Vodeb et al. as possessing four key attributes: attractions, cultural heritage, local gastronomy, and accessibility of the destination. The city's appeal extends beyond seaside tourism, as its surrounding hills attract hikers and mountaineers. In addition to its rich cultural and historical heritage, including villas from the Habsburg era, Opatija's gastronomic offerings are a major draw for visitors. As one of the oldest destinations on the Adriatic coast, the city boasts restaurants serving authentic historical dishes. Opatija's medicinal climate and spa hotels contribute to physical well-being and stress reduction.

Pirot is renowned for its sheep's cheese and ironed sausages. Local restaurants offer a variety of regional specialties, and the town has seen a growth in gastronomic tourism through numerous events. Beyond its culinary delights, Pirot attracts foreign tourists with its rich cultural heritage and the nearby Stara Planina Nature Park, which offers opportunities for outdoor activities like waterfall and canyon exploration. The Stara Planina Hotel houses a wellness center. In the 2022 Gastro Tourism Handbook, Pirot was highlighted as a model for gastronomic tourism, earning the nickname "Little Jerusalem."

The Haut Plateau region's local development strategy combines heritage preservation and culinary promotion. The local population initiated a movement to highlight the region's heritage, particularly its culinary specialties (Bessière, 1998). Laguiola cheese, Aligot traditional dish, and La Fouace local dessert are some of the gastronomic delights for which the region is renowned. In addition to its rich culinary heritage, the French province boasts numerous castles, churches, and nature reserves, attracting tourists seeking cultural experiences and outdoor activities. Les Sources du Haut Plateau is a well-known wellness center with a traditional aesthetic. Bessière emphasizes the role of traditional food and cuisine in rural French areas as markers of identity and drivers of local tourism, promoting a balance between conservation and innovation in local development.

Research Methodology

The paper's initial hypothesis (H) posited that tourist motivations, driven by a rich gastronomic offer and diverse sports and recreational opportunities, contribute to the richness of wellness and spa rural destinations, making them indicators of sustainable development. Given the rural nature of these destinations, it is crucial to leverage both natural and human-made resources to transform potential into tourist attractions and enhance the wellness and spa tourism offerings.

The paper presents findings from two surveys, analyzed using factor analysis. The first survey, focusing on active and sports-recreational tourism, involved 243 respondents, who were the Sunce Hotel and Golden View Garni Hotel guests. The second survey, centered on gastronomy, included 287 guests of the Zelengora restaurant in Sokobanja. The researchers conducted both surveys during the summer months of June to September 2024, making multiple visits to Sokobanja.

To address the research questions "What significance do recreation and active tourism hold for tourists?" and "What type of gastronomy attracts tourists to destinations?", we established the following sub-hypotheses: Recreation and active tourism positively impact tourists' psychological and physical well-being. (h1) and Gastronomic offerings based on local products and traditional preparation methods can foster loyalty to tourist destinations. (h2)

The initial factor analysis yielded a model comprising two factors that categorized the respondents' responses into two dimensions:

- factor analysis 1 identified eight variables associated with the factor "relaxation of body and mind"

Relaxing the mind and body

Enjoying natural environment

Improving personal health/fitness

Staying physically active

Escaping from daily routine to be more productive

Increasing the level of self-confidence

Being with people of similar interests

Spending time with friends

- factor analysis 2 identified 11 variables associated with the factor "unique gastronomic experience"

Portions are generous

I like the quality of the served meat

The organoleptic properties of food satisfy all my senses

The food is real homemade

You can feel the spirit of the space and tradition

The food is traditional, prepared by the recipe that was once used, and you can feel it

Excellent dishes with local ingredients

The food fits the ambiance

The natural materials of the dishes in which the food is prepared and served contribute to the taste

Local music fits into the ambiance

Everything we eat can be traced from "field to table." It is priceless

Sokobanja (Serbia) is a prime example of a spa destination that prioritizes sustainable tourism development. Nestled along the Moravica River, between the mountains of Rtanj, Ozren, and Devica, Sokobanja has a rich history of therapeutic use, dating back to Roman and Turkish times. The first recorded instance of tourism dates to 1837. The town's significant anthropogenic attractions include Sokograd, the Trebič archaeological site, the Amam bath, the monastery of St. Archangel, Knez Miloš Inn, Latin City, and Seselac cave. The abundance of thermal mineral springs, favorable climate, mountainous terrain of Rtanj and Ozren, and strategic location within a valley have contributed to Sokobanja's development as a tourist destination. The region's natural assets, including canyons, caves, Bovan Lake, Vrmdža Lake, and the Moravica River, form the foundation of its tourism industry.

Zelengora restaurant, which has been operating since 2011, has a rich history dating back to 1967. The restaurant specializes in traditional dishes from the 20th century, including kačamak, ajvar, sač dishes, pies, sarma, and beans. A key aspect of Zelengora's approach is its commitment to sourcing ingredients from local producers. Trout is sourced from the Moravica River, dairy products come from a local dairy, and meat products are supplied by a 160-year-old butcher shop. Homemade rakija, crafted from locally sourced fruit, is a significant brand when it comes to spirits served in the restaurant. By prioritizing local food, Zelengora enhances the overall gastronomic experience for tourists.

The Sunce Hotel, initially opened in 1977, underwent renovation and reopened in 2020 following a challenging period of privatization. It boasts the largest accommodation capacity in Sokobanja and offers guests a range of wellness and spa treatments within its 1,300-square-meter wellness center. The Golden View, a high-category accommodation, opened its doors in 2023 and offers a more intimate setting.

Results and Discussion

Of the 243 respondents who participated in the research on active tourism, 144 (59.3%) were male, and 99 (40.7%) were female. The majority of respondents, 177 (72.8%), were from Serbia. Additionally, 30 respondents were from China (12.3%), 18 from Croatia (7.4%), nine from Slovenia (3.7%), and nine from Austria (3.7%). All respondents were guests of the Sunce and Golden View hotels in Sokobanja.

The first factor analysis (see Table 1) yielded a single factor model, explaining 55.165% of the variance. The variables with the highest factor loadings represent two distinct groups of respondent responses regarding the importance of recreation and active tourism.

Table 1. Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.620	55.165	55.165	6.370	53.081	53.081	4.266	35.552	35.552
2	1.637	13.643	68.808	.468	3.903	56.984	2.572	21.432	56.984
3	.807	6.726	75.535						
4	.664	5.531	81.066						
5	.622	5.183	86.249						
6	.496	4.132	90.381						
7	.457	3.807	94.188						
8	.210	1.747	95.935						
9	.154	1.287	97.222						
10	.127	1.058	98.281						
11	.116	.970	99.251						
12	.090	.749	100						

Source: Autor's research

Table 2 reveals strong loadings for eight variables, indicating a strong association with the "relaxation of body and mind" factor. Relaxation is a fundamental practice for stress reduction, achieving life harmony, improved sleep, and overall well-being. Knobloch et al. note that tourism experiences, beyond mere pleasure, have significant implications for well-being and quality of life, necessitating a deeper understanding. The results in Table 2 suggest that key motivations for visiting a destination include escaping routine for the sake of own productivity, socializing with friends, improving health and fitness, and boosting self-confidence. These motivations highlight tourists' desire for vacations that enhance their overall well-being. Consequently, the future of spa tourism lies in developing offerings that integrate wellness, spa, and recreational activities.

Table 2. Factor Matrix

	Factor	
	1	2
V1	.765	-.283
V2	.882	.297
V3	.915	.128
V4	.710	-.001
V5	.928	-.155
V6	.907	-.214
V7	.824	.360
V8	.918	-.118
V9	-.629	.124
V10	-.188	.227
V11	.097	.022
V12	-.136	.055

Source: Autor's research

Today, tourists seek destinations offering diverse recreational experiences. Sokobanja is well-positioned to cater to these desires. The surrounding areas are ideal for both recreational and professional cycling.Adventure enthusiasts can indulge in adrenaline-pumping activities such as scuba diving, mountain biking, free-climbing, orienteering, diving, paragliding, sailing on Bovan Lake, kayaking, and exploring Rtanjska Lednica. The surrounding mountains present challenges for recreational and professional alpinists alike. These activities align with the motivations of tourists seeking to improve their health and fitness. Additionally, Sokobanja offers wellness and spa treatments, as well as an aqua park during the summer months, catering to those seeking relaxation and stress relief. In recent years, rural tourism has gained momentum in Sokobanja. Villages like Vrmdža, Resnik, Trubarevac, Mužinac, Žučkovac, Šarbanovac, and Jošanica have revitalized old accommodations and built new ones to provide comfortable stays. These villages preserve traditions, crafts, and culinary heritage, offering tourists the opportunity to participate in daily life and enjoy the tranquility of the countryside. This type of tourism appeals to those seeking social interaction and immersion in nature, as indicated in Table 3.

Table 3. Descriptive Statistics

	N	Minimum	Maximum	Mean		Std. Deviation	Variance
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic
Relaxing the mind and body	243	1	5	4.25	.059	.922	.850
Enjoying natural environment	243	1	5	4.33	.052	.816	.667
Improve personal health/ fitness	243	1	5	4.28	.058	.906	.820
Staying physically active	243	1	5	4.30	.053	.820	.672
Escaping from daily routine to be more productive	243	1	5	4.30	.056	.871	.758
Increasing the level of self-confidence	243	1	5	4.27	.059	.917	.841
Being with people of similar interests	243	1	5	4.37	.048	.741	.549
Spending time with friends	243	1	5	4.28	.058	.903	.816
Valid N (listwise)	243						

Source: Autor's research

Of the 287 respondents who participated in the research on gastronomy, 147 (51.2%) were male, and 140 (48.8%) were female. The majority of respondents, 217 (75.6%), were from Serbia. Additionally, 25 respondents were from Slovenia (8.7%), 17 from Italy (5.9%), and 12 from the Czech Republic (4.2%). All respondents were guests of the Zelengora restaurant in Sokobanja.

The second factor analysis (see Table 4) also yielded a single-factor model, explaining 80.099% of the variance. The variables with the highest factor loadings were related to the question of whether gastronomy is a primary motivator for visiting the destination.

Table 4. Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.612	80.099	80.099	9.404	78.367	78.367	9.156	76.301	76.301
2	1.018	8.486	88.586	.481	4.006	82.374	.729	6.073	82.374
3	.646	5.382	93.967						
4	.269	2.239	96.207						
5	.111	.921	97.128						
6	.110	.916	98.044						
7	.086	.715	98.759						
8	.061	.505	99.264						
9	.034	.280	99.544						
10	.025	.207	99.751						
11	.020	.169	99.920						
12	.010	.080	100						

Source: Autor's research

Table 5 reveals strong loadings for 11 variables, indicating a strong association with the "unique gastronomic experience" factor. The variables with the highest factor loadings represent distinct groups of respondents' responses related to the survey.

Table 5. Factor Matrix

	Factor	
	1	2
V1	.983	-.142
V2	.924	-.094
V3	.873	-.096
V4	.913	.302
V5	.882	-.078
V6	.931	.303
V7	.952	-.157
V8	.870	-.110
V9	.899	.306
V10	.981	-.164
V11	.954	.271
V12	-.011	-.151

Source: Autor's research

Based on the ratings for all 11 variables, we can conclude that respondents associate unique gastronomic experiences with destinations that preserve tradition and local

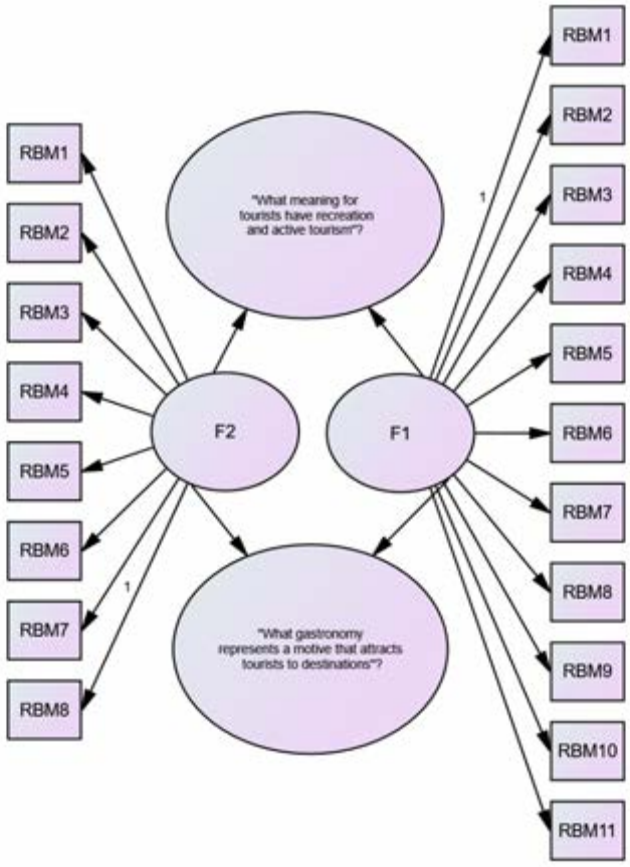
culture and utilize local products, offering a full experience. Sokobanja, with its rich history, offers a glimpse into its past. The region's Roman and Turkish influences are reflected in its culinary traditions. Tourists can savor dishes like "Turkish coffee" and "baklava," with names referring to past periods, but prepared according to local methods and customs. Today, Sokobanja distinguishes itself from similar destinations by offering a diverse range of gastronomic specialties across various local restaurants. Nikolić and Stanković highlight the historical significance of taverns in the region, dating back to 1837. Modern-day restaurants cater to tourists' desires for large portions, high-quality, organic, and homemade food prepared using traditional recipes (Table 6). The preserved historical ambiance and ethnic culture of Sokobanja, combined with its proximity to rural areas, contribute to the authenticity of its culinary offerings. Local sourcing of ingredients enables restaurants to provide genuine homemade dishes while also promoting rural development and generating income for agriculture. This synergy between urban and rural elements fosters a sustainable tourism model.

Table 6. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Portions are generous	287	3	5	3,97	,775	,601
I like the quality of the served meat	287	3	5	4,02	,773	,597
The organoleptic properties of food satisfy all my senses	287	3	5	4,06	,777	,604
The food is homemade	287	3	5	4,08	,791	,626
You can feel the spirit of the space and tradition	287	3	5	4,06	,775	,601
The food is traditional, prepared by the recipe that was once used, and you can feel it	287	3	5	4,06	,786	,618
Excellent dishes with local ingredients	287	3	5	4,01	,789	,622
The food fits the ambiance	287	3	5	4,06	,773	,597
The natural materials of the dishes in which the food is prepared and served contribute to the taste	287	3	5	4,10	,796	,634
Local music fits into the ambiance	287	3	5	3,99	,766	,587
Everything we eat can be traced from "field to table". It is priceless	287	3	5	4,05	,785	,616
Valid N (listwise)	287					

Source: Autor's research

Figure 1. Interdependence of variables. Source: prepared by the authors (2024).



Source: Autor's research

The Figure 1 indicate that recreation and active tourism are significant for tourists primarily due to their association with relaxation of body and mind, as evidenced by strong correlations with eight specific variables (F2). Additionally, unique gastronomic experiences attract tourists to destinations, highlighted by strong associations with eleven distinct variables (F1). This indicates that both relaxation and culinary offerings play crucial roles in enhancing the tourist experience.

Gastronomic experiences significantly impact tourist satisfaction and loyalty, serving as a key motivator for travel decisions (Mora et al., 2021). The integration of food, culture, history, and environment in gastronomic tourism experiences influences consumer choices and contributes to sustainable rural development in wellness and spa tourism. Research suggests that unique gastronomic experiences, offering authentic, unforgettable, and culturally immersive food encounters, significantly impact destination choice, satisfaction, and loyalty. The interconnectedness of recreation and gastronomy positively impacts tourists' physical and mental well-being, fostering

loyalty to the destination. The research findings highlight the numerous benefits of active, gastronomic, wellness, and spa tourism in Sokobanja. However, to remain competitive in the tourism industry, Sokobanja must adapt to emerging trends by prioritizing recreation and gastronomy as key indicators of sustainable development.

Conclusion

The paper discusses the impact of various factors on tourist well-being, particularly in the context of spa tourism in Serbia, which has evolved to include modern wellness concepts and gastronomic experiences. It highlights the growing demand for destinations that offer a blend of traditional spa services, outdoor activities, and local culinary delights, emphasizing the importance of gastronomy in attracting tourists and enhancing their overall experience. Case studies from regions like Istria, Opatija, and Pirot illustrate how local communities can leverage their culinary heritage and natural resources to promote sustainable tourism development, ultimately contributing to the psychological and physical well-being of visitors.

The research on active tourism in Sokobanja involved 243 respondents, predominantly from Serbia, and revealed that relaxation and well-being are key motivations for visiting the area. The findings indicate that tourists are increasingly seeking diverse recreational experiences, such as cycling, adventure sports, and wellness treatments, which align with their desire for improved health and fitness. Additionally, a separate study on gastronomy highlighted the importance of unique culinary experiences tied to local culture and tradition, suggesting that Sokobanja's rich gastronomic offerings significantly enhance tourist satisfaction and loyalty, ultimately contributing to sustainable tourism development in the region.

Sustainable tourism seeks to preserve natural and cultural heritage while fostering local economic growth. While other forms of tourism exist in modern spa centers, the rise of gastronomic and active tourism offers a sustainable approach. These types of tourism contribute to destination development without negatively impacting the environment. Sokobanja's Tourism Development Program (2023-2027) reflects this shift, emphasizing a pristine environment suitable for relaxation through wellness treatments and specific gastronomic experiences (Tomić et al., 2020). This study examines the potential synergy between gastronomic and active tourism, hypothesizing that these two types of tourism can complement each other to create a more attractive offering for a wider range of tourists. Our findings confirm this hypothesis. Tourists engaging in sports and recreational activities also prioritize local dining experiences, highlighting the importance of a robust gastronomic offering in such destinations.

Our findings indicate that recreation and active tourism positively impact visitors' physical and mental well-being. Moreover, a gastronomic offering centered around local products and traditional preparation methods attracts a larger tourist base. This combination of tourism types fosters a sense of loyalty among visitors. The research underscores several key tourist elements of Sokobanja, including its rich wellness

and spa programs. In addition to relaxation, the destination offers opportunities for adrenaline sports, nature walks, and visits to waterfalls, rivers, and lakes. To capitalize on these strengths, the local population should continue to preserve their cultural identity through gastronomic specialties, sourcing local ingredients, and maintaining traditional preparation and serving methods. Sokobanja possesses significant anthropogenic and natural resources, making it well-suited for sustainable tourism development.

Active and gastronomic tourism can drive sustainable development. Sustainable food tourism supports local agriculture and economic growth while offering tourists opportunities to connect with local culture and traditions. Sustainable active tourism promotes healthier lifestyles and active aging for tourists while enabling local communities to develop tourism aligned with their values and aspirations. The synergy between these two forms of tourism benefits both visitors and residents. Future research should involve surveying residents to gauge their perspectives on the importance of gastronomy and recreational tourism. Educating the local population about the benefits of this type of development is crucial. The ultimate goal of developing this kind of tourism is to foster a healthy environment and cultivate loyalty among tourists.

Acknowledgements

Paper is a part of research financed by the MSTDI RS, agreed in decision no. 451-03-136/2025-03/200009 from 4.2.2025.

Conflict of interests

The authors declare no conflict of interest.

References

1. Alexander, R.R., Aragón, R.O., Bookwala, J., Cherbuin, N., Gatt, M.J., Kahrilas, I.J., Kästner, N., Lawrence, A., Lowe, L., Morrison, G.R., Mueller, C.S., Nusslock, Rr., Papadelis, C., Kelly L., Polnaszek, S., Richter, H., Silton, L.R. & Styliadis, C. (2021). The neuroscience of positive emotions and affect: Implications for cultivating happiness and well-being. *Neuroscience & Biobehavioral Reviews*, 121, 220-249, https://doi.org/10.1016/j.neubiorev.2020.12.002.
2. Arsić, M., Vujko, A., & Knežević, M. (2024). Development Perspectives on Wellness and Spa Tourism in the Context of Tourism Business Sustainability. *Sustainability*, 16, 8760. https://doi.org/10.3390/su16208760.
3. Balderas-Cejudo, I., Patterson, G., Leeson, W. (2019). Senior Foodies: A developing niche market in gastronomic tourism. *International Journal of Gastronomy and Food Science*, 16, 100152, https://doi.org/10.1016/j.ijgfs.2019.100152.
4. Bastenegar, M. (2019). From Gastronomy Tourism to Creative and Sustainable Tourism of Gastronomy Case Study: 30 Tir Street Food in Tehran. *MANZAR. the Scientific Journal of landscape*, 11(49), 26-37. https://doi.org/10.22034/manzar.2019.199092.1993

5. Bell, S., Tyrväinen, L., Sievänen, T., Pröbstl, U., & Simpson, M. (2007). Outdoor Recreation and Nature Tourism: A European Perspective. *Living Reviews in Landscape Research*, 1. https://doi.org/10.12942/LRLR-2007-2.

6. Bessière, J. (1998). Local Development and Heritage: Traditional Food and Cuisine as Tourist Attractions in Rural Areas. *Sociologia Ruralis*, 38, 21-34. https://doi.org/10.1111/1467-9523.00061.

7. Bjelić, K., Vujko, A., & Panić, A. (2024). Comparative analysis of the tourist destinations competitiveness in function to improve the tourist offer - Kranjska Gora and Zlatibor case study. *The European Journal of Applied Economics,* 21(2), 88 – 106, https://10.5937/EJAE21-50045,

8. Bojović, P., Vujko, A., Knežević, M., & Bojović, R. (2024). Sustainable approach to the development of the tourism sector in the conditions of global challenges. *Sustainability*, 16(5), 2098. https://doi.org/10.3390/su16052098,

9. Colas, C., Hodaj, E., Pichot, V., Roche, F., & Cracowski, C. (2024). Impact of spa therapy on physical activity, sleep and heart rate variability among individuals with fibromyalgia: Results of an ancillary study. *Complementary Therapies in Clinical Practice*, 57, 101879, https://doi.org/10.1016/j.ctcp.2024.101879.

10. Dimitrovski, D., & Todorović, A. (2015). Clustering wellness tourists in spa environment. *Tourism Management Perspectives*, 16, 259-265, https://doi.org/10.1016/j.tmp.2015.09.004.

11. Djordjevic-Milosevic, S., & Milovanovic, J. (2012). *Održivi turizam u funkciji ruralnog razvoja: Mala poljoprivredna gazdinstva i ruralni turizam u Srbiji*. Izdavač: Fakultet za primenjenu ekologiju Futura, Univerzitet Singidunum, Beograd; Agroznanje, Vršac; FAO, Budimpešta. https://doi.org/10.13140/2.1.4392.8326.

12. Fernández-Gámez, A.M., Rosales-Pérez, A., Molina-Gómez, J. & Mora-Lucena, L. (2018). The effects of outdoor training on the development of emotional intelligence among undergraduate tourism students. *Journal of Hospitality, Leisure, Sport & Tourism Education*, 23, 39-49, https://doi.org/10.1016/j.jhlste.2018.06.001.

13. Gyasi, M.R., Accam, T.B., Forkuor, D., Marfo, O.C., Adjakloe, D.A.Y., Abass, K., Donne, A., Boampong, S.M. & Adam, M.A. (2023). Emotional and physical-related experiences as potential mechanisms linking physical activity and happiness: Evidence from the Ghana Aging, Health, Psychological Well-being, and Health-seeking Behavior Study. *Archives of Psychiatric Nursing*, 42, 113-121, https://doi.org/10.1016/j.apnu.2022.12.023.

14. Hanna, P., Wijesinghe, S., Paliatsos, I., Walker, C., Adams, M., & Kimbu, A. (2019). Active engagement with nature: outdoor adventure tourism, sustainability and well-being. *Journal of Sustainable Tourism*, 27, 1355 - 1373. https://www.tandfonline.com/doi/full/10.1080/09669582.2019.1621883

15. Hjalager, A. M. & Richards, G. (Eds.). (2003). *Tourism and gastronomy*. London: Routledge. https://mint.gov.hr/UserDocsImages/2023_dokumenti/230614_prirucnik_gastro_t.pdf

16. https://sokobanja.rs/aktivnosti/eko-turizam/ (pristup: 15.08.2024)
17. Juan, M., Berbel-Pineda, B., Palacios-Florencio, J., Ramírez-Hurtado, M., Santos-Roldán, L. (2019). Gastronomic experience as a factor of motivation in the tourist movements. *International Journal of Gastronomy and Food Science*, 18, 100171, https://doi.org/10.1016/j.ijgfs.2019.100171.
18. Jurišić, M. (2024). *Specifičnosti ruralnog turizma u Republici Hrvatskoj i komparacija s određenim turističkim odredištima*. Zbornik radova – 4. međunarodna znanstveno-stručna konferencija za razvoj ruralnog turizma „Holistički pristup razvoju studijskih programa menadžmenta i turizma“, Zagreb: Vimal Akademija, str. 44-56.
19. Kim, J.M. & Hall, M.C. (2022). Does active transport create a win-win situation for environmental and human health? The moderating effect of leisure and tourism activity. *Journal of Hospitality and Tourism Management*, 52, 487-498, https://doi.org/10.1016/j.jhtm.2022.08.007.
20. Knobloch, U., Robertson, K., & Aitken, R., (2017). Experience, Emotion, and Eudaimonia: A Consideration of Tourist Experiences and Well-being. *Journal of Travel Research*, 56, 651 - 662. https://doi.org/10.1177/0047287516650937.
21. Koščak, M., & O'Rourke, T. (Eds.). (2023). *Ethical and Responsible Tourism: Managing Sustainability in Local Tourism Destinations* (2nd ed.). Routledge. https://doi.org/10.4324/9781003358688
22. Krunić, N., Stojmenović, G., & Kukolj, S. (2023). The role and significance of audit sampling in the modern enterprise. *Oditor*, *9*(1), 1-16. https://doi.org/10.5937/Oditor2301001K
23. Ladkin, A., Hemingway, A. & Crossen-White, H. (2021). Health, active ageing and tourism. *Annals of Tourism Research Empirical Insights*, 2(2), 100030, https://doi.org/10.1016/j.annale.2021.100030.
24. Lakićević, M., Pantović, D., & Fedajev, A. (2024). Investigating Factors of Customer Loyalty Formation for Wellness Spa. *Management:Journal of Sustainable Business and Management Solutions in Emerging Economies*, 29(1), 53–62. https://doi.org/10.7595/management.fon.2021.0031
25. Miletić, R., Pantović, D., & Veliverronena, L. (2023). Dark tourism in Serbia: Case study of the Kragujevački oktobar Memorial Park. *Hotel and Tourism Management*, 11(1), 127–144. https://doi.org/10.5937/menhottur2301127M
26. Milanović, V., Bučalina Matić, A., & Jurčić, A. (2023). The internal green marketing dimensions, employees' satisfaction, and employees' organizational identification. *Oditor*, *9*(1), 47-70. https://doi.org/10.5937/Oditor2301047M
27. Milojević, I., Mihajlović, M., & Pantić, N. (2020). Collection and documentation of audit evidence. *Oditor*, *6*(2), 77-90. https://doi.org/10.5937/Oditor2002077M

28. Mora, D., Solano-Sánchez, M., López-Guzmán, T., & Moral-Cuadra, S., (2021). Gastronomic experiences as a key element in the development of a tourist destination. *International Journal of Gastronomy and Food Science*, 25, 100405. https://doi.org/10.1016/J.IJGFS.2021.100405.

29. Nikolic, Lj., & Stankovic, S. (2008). *Sokobanja 1837-2007,* Soko Banja: Organization for Tourism, Culture and Sport.

30. Pyo, S. (2005). Knowledge map for tourist destinations — needs and implications. *Tourism Management*, 26(4), 583-594, https://doi.org/10.1016/j.tourman.2004.03.001.

31. Panić, A., Vujko, A., & Knežević, M. (2024): Rural tourism impact on the life quality of the local community: a case study of Western Serbia. Economic of Agriculture, *71*(3), 733–753. https://doi.org/10.59267/ekoPolj2403733P

32. Pantovic, D. ., Parausic, V. ., Radosavljevic, K. ., & Mihailovic, B. . (2025). Rural tourism and local authority satisfaction: Social, economic, and environmental effects . *Journal of Tourism Management Research*, 12(1), 17–26. https://doi.org/10.18488/31.v12i1.4088

33. Pantović, D., Vasović, N., & Mura, L. (2023). Bibliometric analysis of contemporary trends in cultural tourism. *Anali Ekonomskog fakulteta u Subotici*, 59(49), 85-97.

34. Rangus, M., Petek, V., & Gačnik, A. (2023). *Sustainable gastronomy tourism as a tool of local development–the case of the Posavje region*. InM. Koščak & T. O'Rourke (Eds.), Ethical and Responsible Tourism (pp. 472-484). Routledge. https://doi.org/10.4324/9781003358688

35. Reitsamer, B., & Brunner-Sperdin, A. (2017). Tourist destination perception and well-being. Journal of Vacation Marketing, 23, 55 - 72. https://doi.org/10.1177/1356766715615914.

36. Seyitoğlu, F., & Ivanov, S., (2020). A conceptual study of the strategic role of gastronomy in tourism destinations. *International Journal of Gastronomy and Food Science*. https://doi.org/10.31235/osf.io/e9za6.

37. Santiago, K., Yanes, A., & Mercado-Caruso, N. (2024). Analyzing Correlations in Sustainable Tourism Perception: Statistical Insights from Diverse Caribbean Colombian Tourist Sites. *Procedia Computer Science*, 231, 490-495, https://doi.org/10.1016/j.procs.2023.12.239.

38. Tomić N., & Košić K., (2020). Developing the Spa Assessment Model (SAM) and its application on the Kopaonik-Jastrebac spa zone (Serbia), *Tourism Management Perspectives*, 36, 100753, https://doi.org/10.1016/j.tmp.2020.100753.

39. Vodeb, K., & Nemec Rudež, H. (2017). Which attributes are important to tourists in a mature seaside destination? A case of Opatija in Croatia. *Tourism: An international Interdisciplinary Journal,* 65, 267-269.

40. Vujko, A., Cvijanović, D., & Berjan, S. (2024). *Gastronomija kao indikator održivog razvoja ruralnog turizma*. Fakultet za turizam i hotelijerstvo u Vrnjačkoj banji, Univerzitet u Kragujevcu, ISBN: 978-86-89949-84-1, UDK: 338.48-44(1-22):502.131.1641.5, COBISS.SR-ID: 153656329, Str. 280.

41. Vujko, A., & Delić Jović, M. (2024). *Posebni oblici turizma u funkciji održivog razvoja ruralnih destinacija*. Fakultet za turistički i hotelijerski menadžment, Univerzitet za poslovne studije, Banja Luka. Naučna monografija. ISBN 978-99955-95-36-4, COBISS.SR-ID 140204289, str. 176.

42. Vučićević, S., Vujko, A., & Knežević, M. (2024). The role of cycling tourism in the function of sustainable development of Arilje. *BizInfo*, 15(2), 1-10 https://bizinfo.edu.rs/index.php/bizinfo/article/view/346/284

43. Weber, K. (2001). Outdoor adventure tourism - a review of research approaches. *Annals of Tourism Research*, 28(2), 360–377.

44. Winter, P., Selin, S., Cerveny, L., & Bricker, K. (2019). Outdoor Recreation, Nature Based Tourism, and Sustainability. *Sustainability*. 12(1), 81; https://doi.org/10.3390/su12010081

45. Zhu, D., & Xu, H. (2022). Novice tourists' play experience in commercial outdoor adventure tourism: The perspective of reversal theory. *Journal of Outdoor Recreation and Tourism*, 39, 100529, https://doi.org/10.1016/j.jort.2022.100529.

TRENDS AND PERSPECTIVES OF AGRICULTURAL DEVELOPMENT IN SERBIA

Dušan Aničić[1], Olgica Nestorović[2], Jugoslav Aničić[3], Zoran Jovanović [4]

**Corresponding author E-mail: olgica.n@yahoo.com*

ARTICLE INFO

Review Article

Received: *10 February 2025*

Accepted: *10 March 2025*

doi:10.59267/ekoPolj2501375A

UDC 338.435(497.11)

Keywords:

Serbian agriculture, agricultural policy, competitiveness, international market

***JEL**: Q18, M38*

ABSTRACT

In the modern global environment, there is a trend of increasing and changing the structure of demand for agricultural sector products. This situation requires a market-oriented approach from agricultural producers, ranging from economic entities to individual farms. Serbia's agricultural policy is characterized by short-term, ad hoc measures, which prevent predictions and timely adjustments by producers, leaving participants in the market chain uncertain about their long-term orientation. In the total value of agricultural production in 2023, crop production accounted for 69.8%, while livestock production accounted for 30.2%, whereas in developed EU countries, the ratio of crop to livestock production is reversed. This indicates a significant share of low-value-added production, or production with a low level of processing. This paper analyzes the state of Serbia's agricultural sector, which is under pressure from poor agricultural policies, numerous internal weaknesses, and insufficient financial resources in an unstable geopolitical environment.

Introduction

Agricultural producers in Serbia today face competition in the domestic market, but also have opportunities to enter international markets such as the EU, Russia, and others. This means that products should not only be low-cost but also of higher quality

1 Dušan Aničić, PhD, Assistant Professor, Faculty of Economics and Finance, University Union-Nikola Tesla, Cara Dušana 62-64, 11 000 Belgrade, Serbia, Phone: +381 64 40 82 692, E-mail: anicic.dusan@yahoo.com, ORCID ID (https://orcid.org/0000-0003-1201-0532)

2 Olgica Nestorović, PhD, Assistant Professor, PUC"Kruševac", Kruševac, Nikole Čolovića 2, 37000 Kruševac, Serbia, Phone:+381648143000, E-mail:olgica.n@yahoo.com, ORCID ID (https://orcid.org/0000-0001-5039-9353)

3 Jugoslav Aničić, PhD, Full Professor, Faculty of Economics and Finance, University Union-Nikola Tesla, Cara Dušana 62-64, 11 000 Belgrade, Serbia, Phone: +381 64 24 77 199, E-mail: ajugoslav@yahoo.com, ORCID ID (https://orcid.org/0000-0003-3467-7071)

4 Zoran Jovanović Ph.D., Associate Professor, University of Pristina, Faculty of Agriculture, Kopaonička Street nn, 38219 Lesak, Serbia, Phone +381 642021391, E-mail: zoran.jovanovic.polj@pr.ac.rs, ORCID ID https://orcid.org/0000-0003-3331-798X

compared to the competition, which requires the practical application of modern knowledge and innovations. When examining the structure of agricultural production value in 2023, a high share of crop production (69.8%) can be observed compared to livestock production (30.2%), which is entirely opposite to agricultural production in EU countries. It is indisputable that the results of the agricultural sector are weak, considering that Serbia is a country with comparative advantages in agricultural production and a traditional food exporter.

The aim of this paper is to highlight the necessity and possibilities for increasing the competitiveness of the agricultural sector. In practical terms, this means focusing on the preservation of natural resources and the environment, the revival of agricultural cooperatives, and incentive measures for small farms.

The Role of Agriculture in the Modern Global Environment

The global market is dominated by large multinational companies that determine global production, trade, and investment flows, thereby managing the world economy. Modern trends of mergers, acquisitions of smaller companies, and consolidation have become an unavoidable trend, even in transition countries. These countries must adapt to the emerging situation and create the conditions for the sustainable development of their economy and the enhancement of its competitiveness on the international level.

The most significant changes in the international business environment include reduced market barriers, rapid market shifts, constant competitive pressures, large-scale separations or mergers, and global approaches to capital markets (Danielle, et al., 2006). New trends in the globalized market require management to ensure the successful positioning of a company in the global market while also adapting to the challenges of local markets.

The process of economic reforms in transition countries followed the recommendations of the Washington Consensus, strongly supported by the IMF and the World Bank as the main proponents of the neoliberal economic concept. Between 1990 and 2000, most transition countries had a negative growth rate (EBRD, 2010). In addition to the recession, there was a noticeable rise in unemployment and an increase in social stratification among the population. After 2000, until the outbreak of the global economic crisis, transition countries experienced high rates of economic growth (an average of 5.7%) and optimistic forecasts for further growth (Lissowska, 2014).

The global order is deliberately disorganized to ensure that large capital becomes the only significant player on the world stage: in such a system, the winners are few, while the majority of the world's population falls into despair and poverty (Samardžić, 2018).

Frequent crises weaken economic activity, reduce consumption and investment, leading to a slowdown in economic growth, loss of jobs, and wage reductions. Most countries face the issue of budget deficits and how to finance them. Due to macroeconomic instability, countries enter into appropriate agreements with the IMF, thus increasing

their external debt. According to Stiglitz (2004), global financial institutions have not provided answers to the development problems of developing countries, so new solutions need to be offered that ensure economic development through the cooperation of the state and the market.

As a consequence of the pandemic and the energy crisis in 2022, inflation affected the most developed Western countries, and its negative impact has been felt across all sectors of the economy and on the standard of living of the population. Agriculture was hit hard by inflationary trends and, alongside energy, became the sector with the highest inflation, particularly in terms of food prices. Inflation, as an indicator of economic conditions, shows a time lag of at least 18 months. This also represents the biggest challenge in conducting monetary policy, given the contemporary economic conditions that are becoming more complex every day and increasingly unpredictable, subject to a growing number of diverse economic factors (Andrić, 2021).

The immediate determinants of economic growth are the investment rate, employment, and technical progress, while additional factors include the economic environment, which encompasses macroeconomic stability (exchange rate stability, inflation, tax policy, interest rates, and infrastructure). Fundamental growth factors include geographical factors, historical heritage, culture, and institutions (Arsić, Gligorić, 2024). The most successful episodes of economic growth have generally been based on several common characteristics, such as an ambitious reform package, productivity growth, an increasing share of investment in GDP, and financial system development (Šoškić, 2024).

In recent years, environmental issues and the economic adjustment to the "green agenda" have become more prominent, with investments being directed into energy sectors that produce green energy, under the dominance of the strongest global players. Thanks to cheap money, 2021 saw historic records in mergers, acquisitions, and consolidations of companies, making global companies and monopolies increasingly powerful, while wealth centralization continues to grow (Katić, 2022).

Due to all of the above, the IMF and World Bank revised their forecasts for global economic growth in 2023, reducing them (Kovačević, Stančić, 2022).

In the global market related to agriculture, globalization has resulted in reduced incomes for farmers, increased dependence on subsidies, and huge profits for intermediaries who control the market, thus preventing any form of competition that would benefit producers (Sol, Ralston, 2011).

Such trends threaten the country's concept of sustainable development, which is based on three main aspects: balanced economic growth (economic aspect), environmental protection and preservation (ecological aspect), and the respect and advancement of social and human rights (social aspect). The sustainable development strategy also represents a process of seeking vision and solutions for sustainability in society (Milosavljević, 2009).

The preservation of nature and its resources emerges as a primary goal of all developmental efforts, ahead of production, economic, regional, and other goals (Pokrajac, 2009).

Although Serbian agriculture has a low level of productivity, it benefits from high-quality arable land, a favorable continental climate, and an abundant workforce. To increase productivity in this sector, greater investment is needed in new technologies, modernization of existing equipment, and the development of agricultural sectors that contribute to higher added value.Therefore, further agricultural development and productivity improvement require investments, adequate financing, and investment across the entire agribusiness value chain (Atanasijević & Danon, 2014).

Financial support from the state should manifest in greater budget allocation for the agricultural budget, as well as in directing the use of other financial instruments, such as EU pre-accession funds (IPARD), securities, financial derivatives, etc. (Radović, 2015).

There are numerous factors that have negatively affected the financing of the agricultural sector.These limitations can be broadly summarized as follows: inconsistent agricultural policy; inefficient subsidy programs; regulatory disincentives or lack of regulation; few alternative financing sources; lenders' knowledge and risk perception in agribusiness; knowledge and access to information; failure to utilize the advantages offered by the value chain concept; high sector risk, etc. (Dimitrijević, 2023).

The level of competitiveness of the national economy reflects a country's ability to produce goods and services under competitive conditions, ensuring long-term sustainable growth and development. Despite the growing impact of globalization processes, national competitiveness is determined by a range of factors that depend on specific, local conditions (Porter, 2008).

The development of modern agriculture requires knowledge and innovations in various fields (Asenso-Okyere, Davis, 2009), ranging from technology, development of modern institutions, timely and adequate agricultural policies, to organization (both public and private groups and companies that need to innovate to become more efficient and effective in the services they provide). Improving the current state of agricultural production requires knowledge and innovation, including new technologies, modern institutions, and agricultural policies aimed at enhancing the competitiveness of agricultural producers. Knowledge as a source of innovation and successful adaptation to the changes in consumer demand is a key determinant for successfully facing competition, preserving existing markets, and gaining new ones (Vasiljević, Savić, 2014).

According to Arsenijević and colleagues (2016), agriculture will struggle to achieve higher levels of productivity and market success if the entire rural activity does not overcome certain depressive factors. One of the main reasons is the low profitability, which results in a lack of financial opportunities for investment and development, further leading to the migration of young people from rural areas.

According to Stefanović and Broćić (2012), global trends encourage more balanced

development and increased food production, along with rapid, rational, and organized distribution of agricultural and food products to all parts of the world. In economic theory, it can be observed that when agricultural and food products dominate the export structure of a national economy, it suggests a lower level of economic development in that country.

However, in some developed countries, agricultural product exports are a significant item in the foreign trade balance (Netherlands, Denmark, France, etc.). Byerlee and colleagues (2009) emphasize that every country should recognize the multiple functions of agriculture and its impact on overall economic development.

The importance of agriculture in the EU can be understood through several data points that illustrate the sector's role in the economy of this community. In the agricultural production sector in EU countries, only 8.3% of the total working-age population is employed. This percentage varies significantly between different countries: in the "old" EU member states (15 industrially developed Western European countries), the average value is 4%, while in the "new" EU member states (Romania, Bulgaria, Slovakia, Hungary), more than 12% of the total workforce is employed in agriculture and the food industry (Vapa-Tankosić, Stojsavljević, 2014).

Gulan (2016) expects agriculture to drive economic development, increase gross domestic product, and serve as the backbone of overall economic stability. The share of agriculture in the gross domestic product ranges from 15% to 40%, which implies that this sector can significantly contribute to future economic development.

For this reason, agriculture should be supported to fully utilize natural, human, and processing capacities, which are currently only being used to a third of their potential. Effective use of agricultural potential is possible if small agricultural producers are connected to markets in a way that allows them to achieve higher profits and other benefits (Zakić et al., 2014).

The achieved level of agricultural development is the result of the absence of a fundamental concept for the development of agricultural production and the active involvement of the private sector in this activity. Despite this situation, the importance of agriculture in Serbia's foreign trade balance and overall employment should be particularly emphasized, considering the country's debt problems and high unemployment rate (Aničić et al., 2016).

Despite the significant importance of the agricultural sector, a sufficiently stimulating socio-economic environment for the development of rural areas and agriculture has not yet been created, particularly in certain regions and areas of the Republic of Serbia (Ristić, 2013).

Byerlee and colleagues (2009) emphasize that the new paradigm should recognize the multiple functions of agriculture and its impact on overall development. The functions of agriculture will have serious repercussions on the overall economic development of the country, both in terms of economic parameters and those related to the natural environment.

The contribution of agriculture should be considered through: 1) the share of agriculture in the total population and the share of active agricultural population in the total workforce, 2) agriculture's share in gross domestic product (GDP), and 3) the contribution of agriculture and agro-industry in foreign trade exchanges. Analysis of these indicators suggests that our development strategy must be based on increasing the export of agricultural and food products (intensive production) and altering the production structure to align with purchasing demand (especially the demand for ecologically healthy food), with a higher degree of finalization, to increase competitiveness and create new value (Mitrović et al., 2017).

If we consider the added value per worker in agriculture as a measure of labor productivity, there is a constant and significant lag behind the EU, which highlights the importance of an adequate policy of financing and investing in agriculture, all aimed at technical-technological progress, innovation, acquiring new knowledge, and increasing productivity in Serbian agriculture (Dimitrijević et al., 2023).

It can be observed that allocations for the implementation of agricultural policy in 2023 have significantly increased, which acts as a positive motivating factor for all agricultural producers. Agricultural incentives aim to ensure the stability of domestic food supply, increase sales and exports, and create new jobs (Kuzman et al., 2017).

The Future of Agriculture in Serbia: Challenges and Development Opportunities

The agricultural sector can significantly contribute to the country's economic growth and seriously improve certain economic parameters in a positive sense if a clear strategic development concept for this sector is defined.

Natural resources and a favorable continental climate can be considered favorable conditions that impact agricultural production in Serbia.On the other hand, one of the significant problems is the fragmentation of land parcels, with the majority of farms being smaller than 5 hectares (Stojanović, 2022).

In the structure of Serbia's economy, traditional sectors dominate (construction, food industry, tire and metal production, agriculture, mining), with low productivity and small added value. As a result, Serbia has not managed to reduce the developmental gap with Central and Eastern European countries over the last 20 years, remaining at only 60% of the average development level of those countries (Petrović et al., 2024). By comparison, Croatia, Romania, and Bulgaria are already at 90% of that average.

The most significant reasons for the slower growth of agriculture compared to other sectors include (Devetaković et al., 2009):

- Unfavorable conditions for doing business over a long period of time.
- Inconsistency in formulating and implementing the development concept of this sector,

- Long-standing restrictions, particularly regarding private landownership,
- Insufficient involvement of the private sector in agriculture.
- Insufficient implementation of irrigation and land reclamation measures.

Data from Table 1 show an upward trend in Serbia's economy in all years, except for 2020 when, as a consequence of the COVID-19 crisis, negative growth rates were recorded in most indicators. During the observed period, there was significant growth in GDP, as well as other economic parameters that show growth.This environment certainly has a positive impact on the trends within the agricultural sector.

Table 1. Macroeconomic Indicators

	2017	2018	2019	2020	2021	2022	2023
GDP growth rates (%)	2,1	4,5	4,3	-0,9	7,5	2,6	3,8
Export of goods and services (billion E)	19,3	21,2	23,3	22,3	28,6	38,0	41,0
Import of goods and services (billion E)	22,3	25,3	28,0	26,4	33,1	45,0	44,5
Foreign market. deficit (billion E)	-3,0	-4,1	-4,6	-4,1	-4,5	-7,0	-3,5
Public debt (% GDP)	58,7	54,4	52,8	57,8	57,1	52,4	48,0
Fiscal deficit/surplus (% GDP)	1,1	0,6	-0,2	-8,0	-4,1	-3,3	-2,2
Unemployment rate (15 +)	14,5	13,7	11,2	9,7	11,0	9,5	9,4
Ref. NBS rate (end of term)	3,5	3,0	2,3	1,0	1,0	6,5	5,75
Foreign exchange reserves of the NBS (in millions of E	9.962	11.262	13.378	13.492	16.455	19.416	24.909
Gross domestic product (GDP)	40.828	44.711	48.105	49.024	55.931	63.501	75.204

Source: National Bank of Serbia, 2024: Key Macroeconomic Indicators

According to the data in Table 2, we can see that total agricultural production grew year by year, except for 2023, when a decline occurred.

Table 2. The price of goods and services in agriculture**.**for the Current Year, 2017-2023(in million RSD)

	2017	2018	2019	2020	2021	2022	2023
I Production of goods and services	543.746,5	589.704,3	605.291,2	667.854,8	724.332,4	841.685,3	773.010,6
1. Production of agricultural goods	529.890,4	574.703,9	589.978,3	651.631,7	707.213,2	821.507,6	752.671,7
1.1.Plant production	357.056,3	398.513,5	414.528,6	473.693,3	544.202,2	590.920,8	521.272,1
1.2.Livestock production	172.834,0	176.190,4	175.449,7	177.938,3	163.011,0	230.586,8	231.399,6
II Agricultural services	13.856,1	15.000,5	15.313,0	16.223,2	17.119,2	20.177,7	20.338,9

Source: Republic Statistical Office, Statistical Yearbook of the Republic of Serbia, 2024

The data from Table 2 show a significant increase in goods and services in the agricultural sector, which will have positive implications for the overall development of the country.

In 2017, the ratio was 67.38% for crop production and 32.62% for livestock, indicating a decrease in the share of livestock in total agricultural production. Primary livestock production is predominantly found in small-scale agricultural households. Today, livestock farming is at an exceptionally low level of development. Primary agricultural production and the food industry are fundamental to economic growth and development and are an important component of the overall national economy due to their contribution to GDP and overall employment.

From the data in Table 3, we can observe the trends in the export and import of agricultural products, as well as that Serbia consistently achieves a trade surplus in the observed period. However, the potential for growth is much higher than the actual results. When examining the export structure, a higher share of processed products can be observed, which creates added value compared to primary products. As for imports, it is characteristic that products of questionable quality and lower prices are often imported, even though there are surpluses in domestic production (meat, milk, corn, certain vegetables, etc.).

Table 3. Foreign Trade of Agricultural and Food Products for the Period 2017-2023
(in millions of euros)

DESCRIPTION	2017	2018	2019	2020	2021	2022
Export of agriculture	888	886	1.070	1.284	1.331	1.273
Import of agriculture	647	571	617	632	724	924
Surplus/deficit	241	315	453	652	607	349
Coverage of imports by exports (in %)	137,25	155,17	173,42	203,16	183,84	137,77

Source: Republic Statistical Office, 2024

Desirable activities to improve the status of small family farms include vertical integration (connecting producers with the market) as well as horizontal integration (connecting producers with each other). In addition, organic production represents a great opportunity for small family farms, given the growing awareness of the importance of healthy food and the global increase in demand for food products.

The share of the agricultural budget in the total budget in 2023 was 5%, with the highest share of the agricultural budget reached in 2013, at 5.79% of the total budget. The main goals of the agricultural budget are to increase production, productivity, exports, monitor technological innovations, improve product quality, develop rural areas, and halt depopulation.

Conclusion

In Serbia, agriculture represents a significant potential for the economic and industrial development of the country, although an environment conducive to the development of rural areas and agriculture, which would yield maximum effects, has not yet been fully established. Agricultural policy should define potential agricultural sectors that could be competitive in the domestic market and gradually improve through new technologies and the application of new knowledge. This would also create opportunities for entering international markets.

It is very important to emphasize that this competitiveness should not be based on low input costs, but on the application of sophisticated solutions in agriculture. Additionally, access to financing must be made easier and simplified. Through such measures, it is possible to change the agricultural structure towards high value-added sectors and halt negative trends such as depopulation of rural areas and underdeveloped regions.

Conflict of interests

The authors declare no conflict of interest.

References

1. Andrić, Dj. (2021). Application and effects of inflation targeting as a strategy of the National Bank of Serbia. *Economic Perspectives*, XXVI(3-4), 271-287. ISSN 0354-9135. UDK-33 COBISS.SR-ID 116154887.
2. Arsić, M., & Gligorić, M. (2024). Impact of fundamental factors on the economic growth of Serbia. Scientific Conference: Economics: Economic Development and Its Determinants, SANU, Belgrade.
3. Atanasijević, J., & Danon, M. (2014). Financing agricultural development in Serbia: Opportunities and challenges. *Enterprise Economics*, 62(1-2), 67-81.
4. Anićić, J., Vukotić, S., & Krstić, J. (2016). Achieved results and strategic aspects of agricultural development in Serbia during the transitional period. *Agricultural Economics*, 63(1), 175-189.
5. Asenso-Okyere, K., & Davis, K. (2009). Knowledge and innovation for agricultural development. IFPRI Policy Brief 11.
6. Byerlee, D., Janvry, A., & de Sadoulet, E. (2009). Agriculture for Development: Toward a New Paradigm. *Annual Review of Resource Economics*, 1, 15-31.
7. Gulan, B. (2016). The state and the village: Saving the village and agriculture. www.makroekonomija.org
8. Danielle, M. W., Thomas, W., & Joerg, S. (2006). Doing Business Internationally: The Guide to Cross-Cultural Success. McGraw-Hill, New York.
9. Dimitrijević, M. (2023). Trends in financing agriculture in the Republic of Serbia. *Banking*, 52(4).

10. Dimitrijević, M., Vujičić, M., & Ristić, L. (2022). Innovative approaches in agricultural development. *Megatrend Review*, 19(3), 183-198. doi: 10.5937/MegRev2203183D.
11. Devetaković, S., Gavrilović, Jovanović, B., & Rikalović, G. (2009). National economy, Faculty of Economics, Belgrade.
12. EBRD (2010). *Transition Report: Recovery and Reform*.
13. Lissowska, M. (2014). Welfare against growth gains in post-transition countries. What are the consequences for stability? http://dx.doi.org/10.5018/economic-ejournal.ja.2014-13
14. Katić, N. (2022). Global politics and economics in 2022: Inflation, big words, and selfish interests. RTS website.
15. Kovačević, M., & Stančić, K. (2022). Some aspects of a possible recession in 2023 – What history teaches us. *Macroeconomic Analyses and Trends*, Economic Institute and Chamber of Commerce of Serbia, Belgrade.
16. Kuzman, B., Djurić, K., Mitrović, L., & Prodanović, R. (2017). Agricultural budget and agricultural development in the Republic of Serbia. *Economics of Agriculture*, 64(2), 515–531. https://doi.org/10.5937/ekoPolj1702515K.
17. Milosavljević, S. (2009). *Sustainable development policy*, Niš.
18. Mitrović, S., Mitrović, A., & Cogoljević, M. (2017). Contribution of agriculture to the development of Serbia. *Economics of Agriculture*, 2, 805-819.
19. National Bank of Serbia (2024). *Basic macroeconomic indicators*.
20. Pokrajac, S. (2009). Sustainable development and ecological economics as business paradigms. *Business School Journal*, 4, 21-30.
21. Petrović, P., Berčerević, B., & Minić, S. (2024). Economic growth of Serbia: Determinants and future prospects. Scientific Conference: Economics: Economic Development and Its Determinants, SANU, Belgrade.
22. Porter, M., et al. (2008). Moving to a New Global Competitiveness Index.
23. Chamber of Commerce of Serbia (2025). Association for Plant Production and Food Industry of the Chamber of Commerce of Serbia, Belgrade.
24. Radović, G. (2015). Financing agriculture in the Republic of Serbia: Experiences and opportunities. *Economics: Theory and Practice*, 8(4), 13-27.
25. Ristić, L. (2013). Strategic management of sustainable rural development in the Republic of Serbia. *Economic Horizons*, 15(3), 229-243.
26. Stiglitz, J. E. (2004). The Post-Washington Consensus. The Initiative for Policy Dialogue.
27. Stefanović, R., & Broćić, Z. (2012). Quality as a determinant of the export growth of agricultural-food products from the Republic of Serbia. FQ2012 - Quality Festival, pp. A267-A273.

28. Samardžić, M. (2018). *Geography of Capitalism*, New Serbian Political Thought, Belgrade.
29. Sol, R. Dž. (2011). The Collapse of Globalism and the Reconfiguration of the World, *Arhipelag*, Belgrade.
30. UN (2013). Department of Economic and Social Affairs Population Division.
31. Stojanović, Ž. (2022). Agriculture in Serbia. In: Manić, E., Nikitović, V., & Djurović, P. (Eds.). *The Geography of Serbia: Nature, People, Economy* (199-206). World Regional Geography Book Series. Springer, Cham. https://doi.org/10.1007/978-3-030-74701-5_15.
32. Vasiljević, Z., & Savić, B. (2014). Knowledge and intellectual capital – sources of competitive advantage in Serbian agriculture. *Economic Perspectives*, XIX(1), 11-24.
33. Vapa-Tankosić, J., & Stojsavljević, M. (2014). EU Common Agricultural Policy and Pre-accession Assistance Measures for Rural Development. *Economics of Agriculture*, 61(1), 195-210.
34. Zakić, N., Vukotić, S., & Cvijanović, D. (2014). Organizational Models in Agriculture with Special Reference to Small Farmers. *Economics of Agriculture*, 61(1), 225-239.
35. Šoškić, D. (2024). Capital market as a factor of investment growth and economic development in Serbia. Scientific Conference: Economics: Economic Development and Its Determinants, SANU, Belgrade.

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:

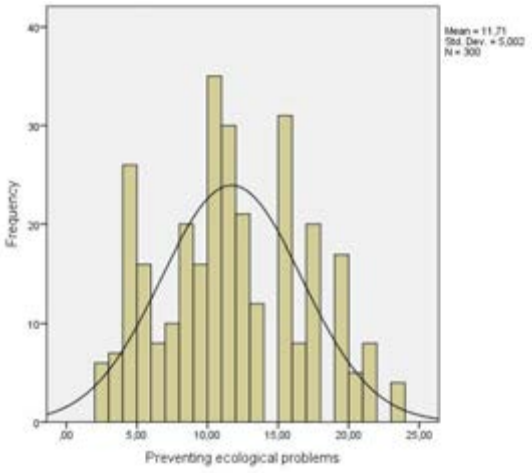
Table 1. The distribution cost of packaged goods from Subotica to retail-store objects

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 Science, Technological Development and Innovation of the Government of the Republic of Serbia provides financial support for the publication of the quarterly journal ECONOMICS OF AGRICULTURE